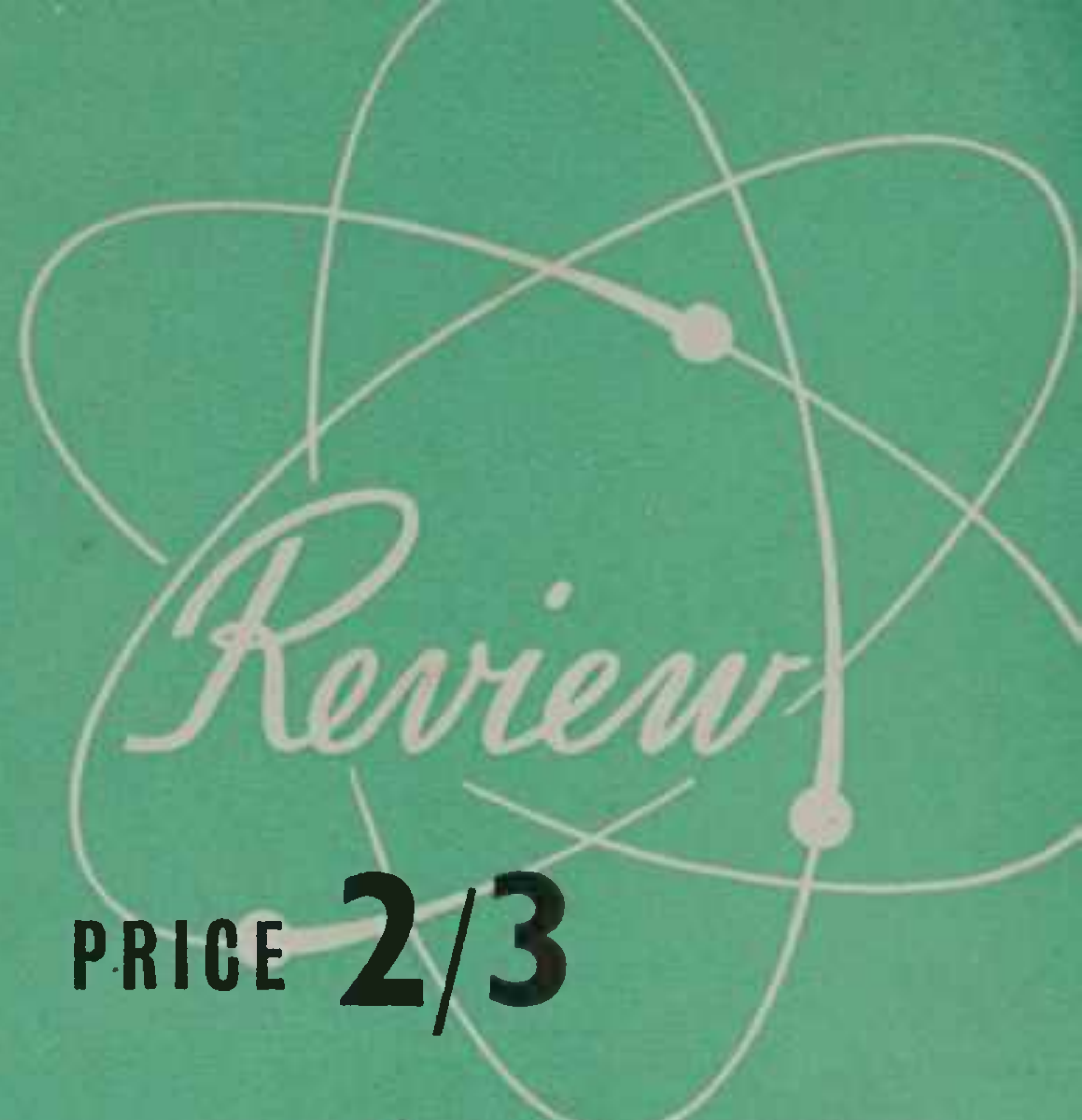


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OCTOBER, 1957

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Radio and Electrical Review

VOL. 12, No. 8

OCTOBER, 1957

Official Journal of
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The New Zealand Radio and Electrical
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Sole New Zealand Distributors: Gordon & Gotch (N.Z.) Ltd., Wellington

*Editorial***Political Capital From "Ham" Radio ?**

This journal received something of a shock the other day. It is the first time in our experience that a political party has attempted to make capital, in terms of votes, out of the amateur radio movement and, frankly, we take a "poor view" of such goings on.

Let there be no mistake. We are not accusing the New Zealand Association of Radio Transmitters (Inc.) of subscribing to the action of two amateurs, who may or may not belong to the Association, or of countenancing it in any way. On the contrary, our own knowledge of the Association and of those who run its affairs leads us to believe that this body, as a whole, will feel just as strongly as we do ourselves on this violation of the unwritten laws of amateur radio.

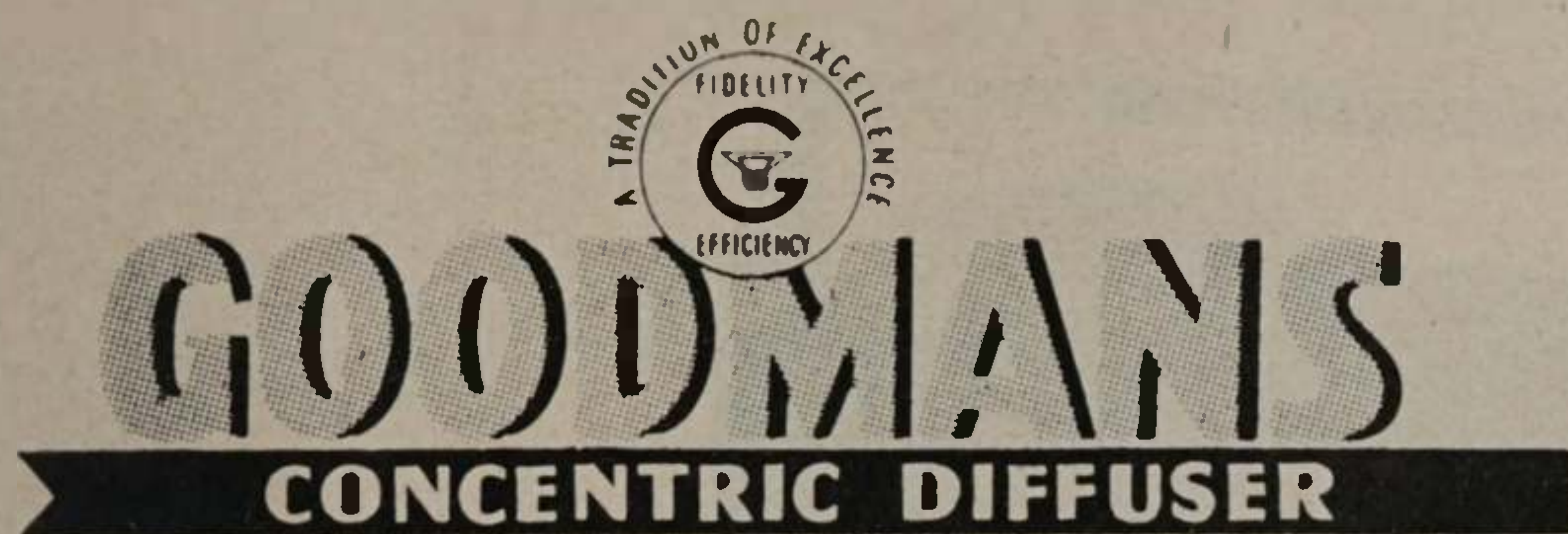
Throughout the world the amateur transmitting movement has always held the strongest views on the strict interpretation of the word "amateur," and rightly so. Amateur radio is a great and powerful hobby, and it will remain so only by most jealously guarding its amateur status. This does not mean simply that an amateur transmitter should not use the pursuit of his hobby for pecuniary gain. There is a much wider significance attached to the term "Amateur Radio" than that. It is in just as poor taste to use one's standing as a "ham" for political ends as it would be to do the same for commercial purposes.

We have no objection to the gentlemen concerned holding what political views they please, nor to their attempting to propagate the doctrine of their political party. This is a free country, in which it is their right to do so. But we do question the ethics of their going about it in the way they have done.

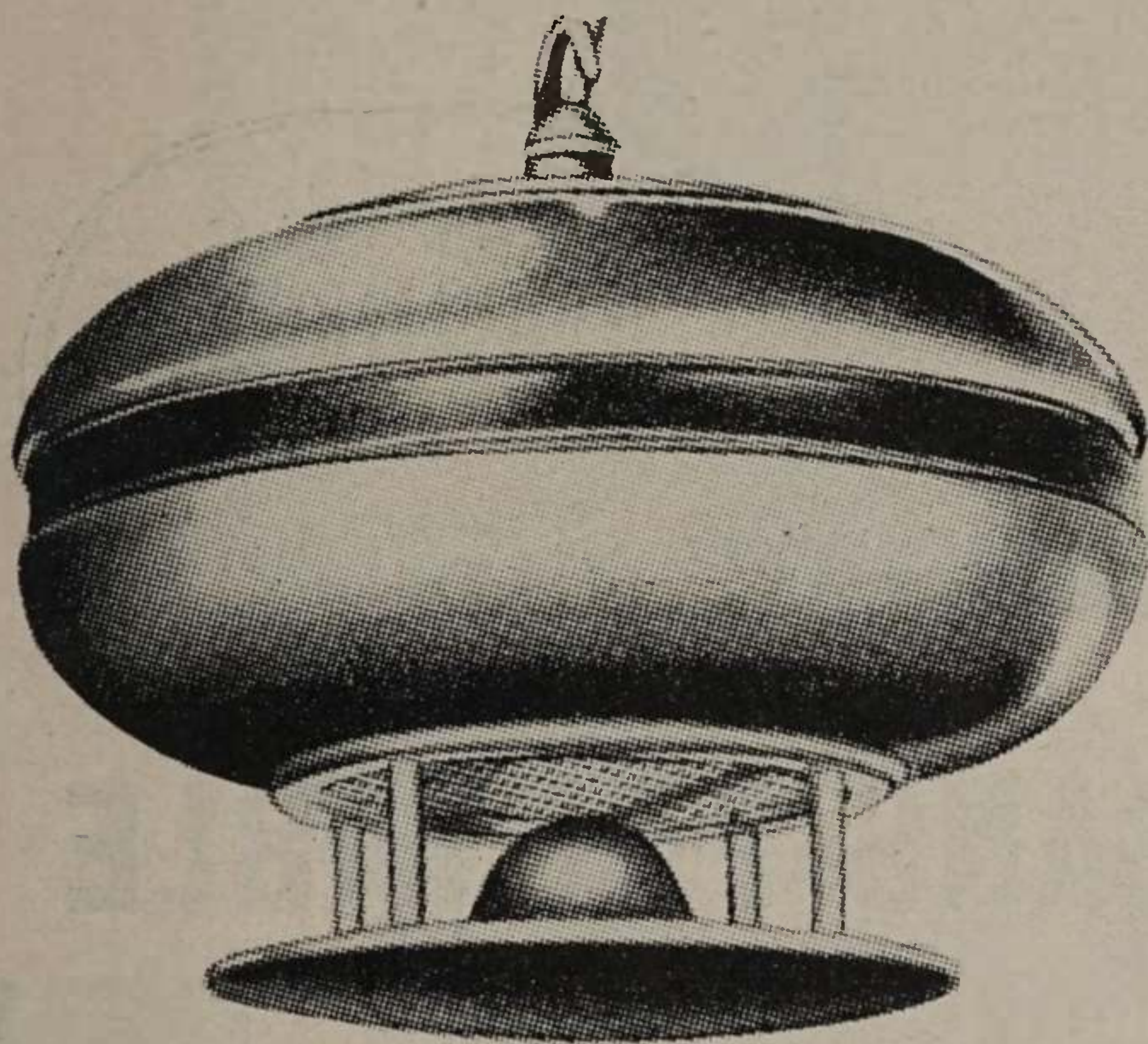
Not all our readers will be aware of just what was done that we are objecting to, so perhaps we had better explain. Two amateur transmitters sent through the post, presumably to every radio amateur in the country, four cyclostyled pages of propaganda for their political party, which has clearly influenced them to do so on account of their association with radio, and because the party in question purports to have a strong policy on broadcasting and all matters pertaining thereto. Further, the envelopes were addressed (so our information goes) using the recipients' call-signs, and the material enclosed was written in the distinctive way in which "hams" address each other, obviously attempting to play on the sense of camaraderie and fellowship that exists among amateurs throughout the world, just because they ARE hams. Indeed, nothing could be more blatant. The signers of the letter even use their own call-signs and amateur "handles" in doing so.

As one amateur put it to us, this sort of thing constitutes not only invasion of privacy, but breach of privilege. The first because being a member of the amateur radio fraternity has nothing whatever to do with one's political convictions, and the second because, ethically, no one has a right to take advantage, in ways of no concern to the hobby, of the privilege of belonging to it.

It is unlikely that the Council of the N.Z.A.R.T. will take any action against the members who have offended the canons of good amateur taste, since to do so would possibly have the reverse of the desired effect, even if any action were possible. As we have said, it is the unwritten laws that have been broken, and the people concerned may not even be members of the organization. It is partly for this reason that we take up the cudgels on behalf of the N.Z.A.R.T., and without their knowledge.



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It uses a high-flux P.M. Loudspeaker mounted in a Helmholtz resonator of optimum volumetric capacity, the diaphragm being fully loaded down to 50 c.p.s. The "CD/77" has a frequency range from 50 c.p.s. to 10,000 c.p.s. free of sub-harmonics and bass modulation effects. Its outstanding design guarantees sound waves evenly spread over a radius of 360 degrees.

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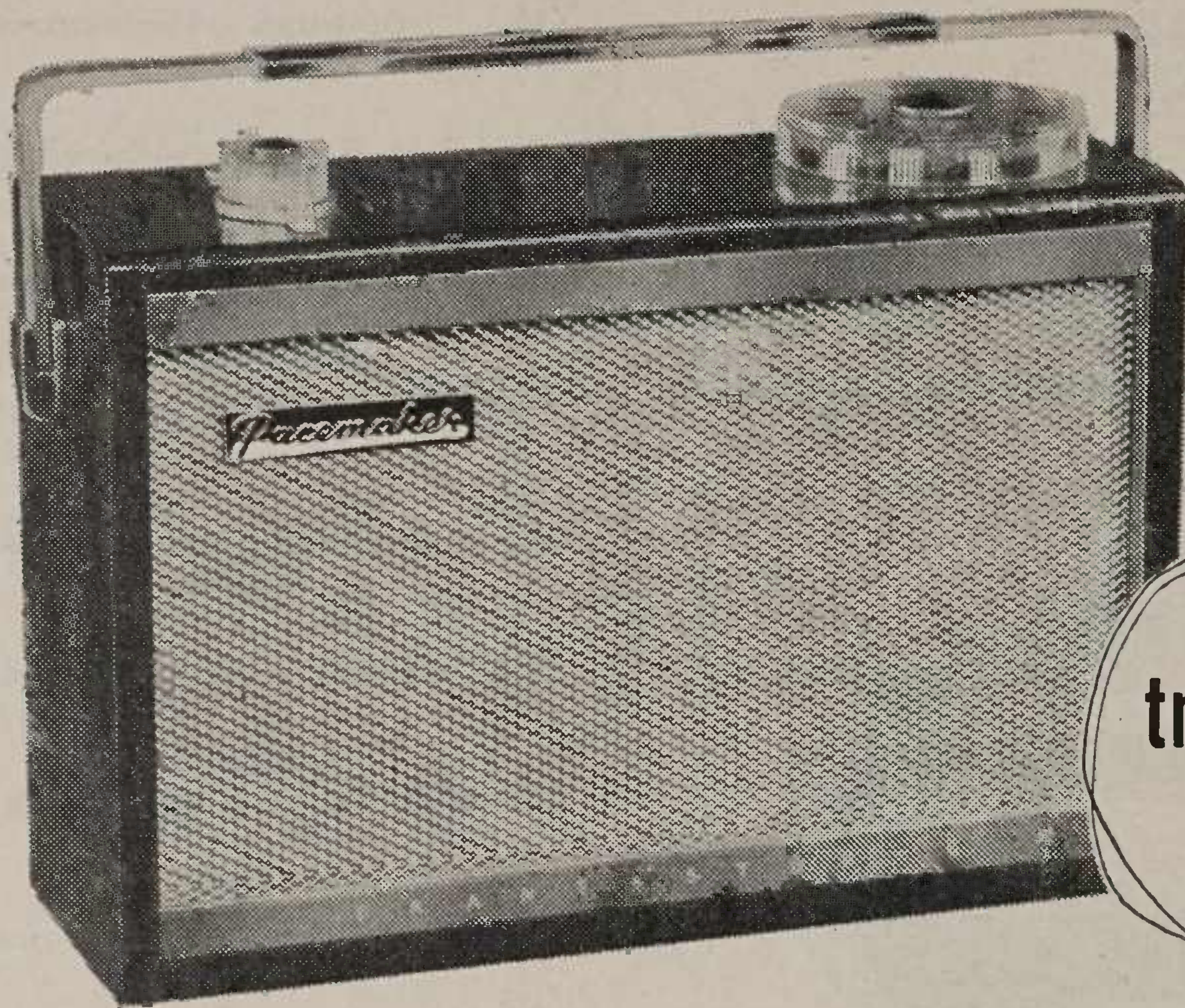
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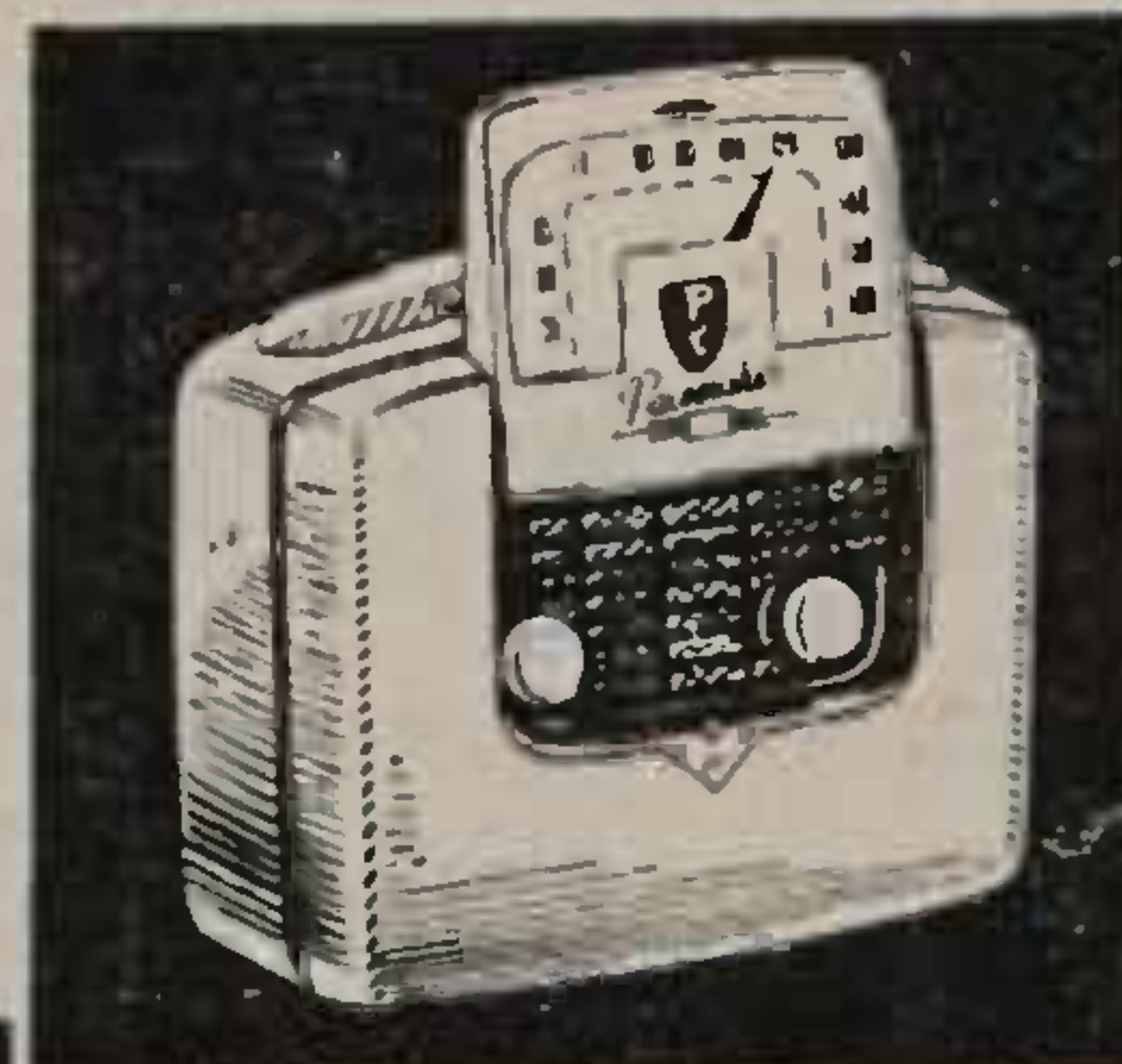


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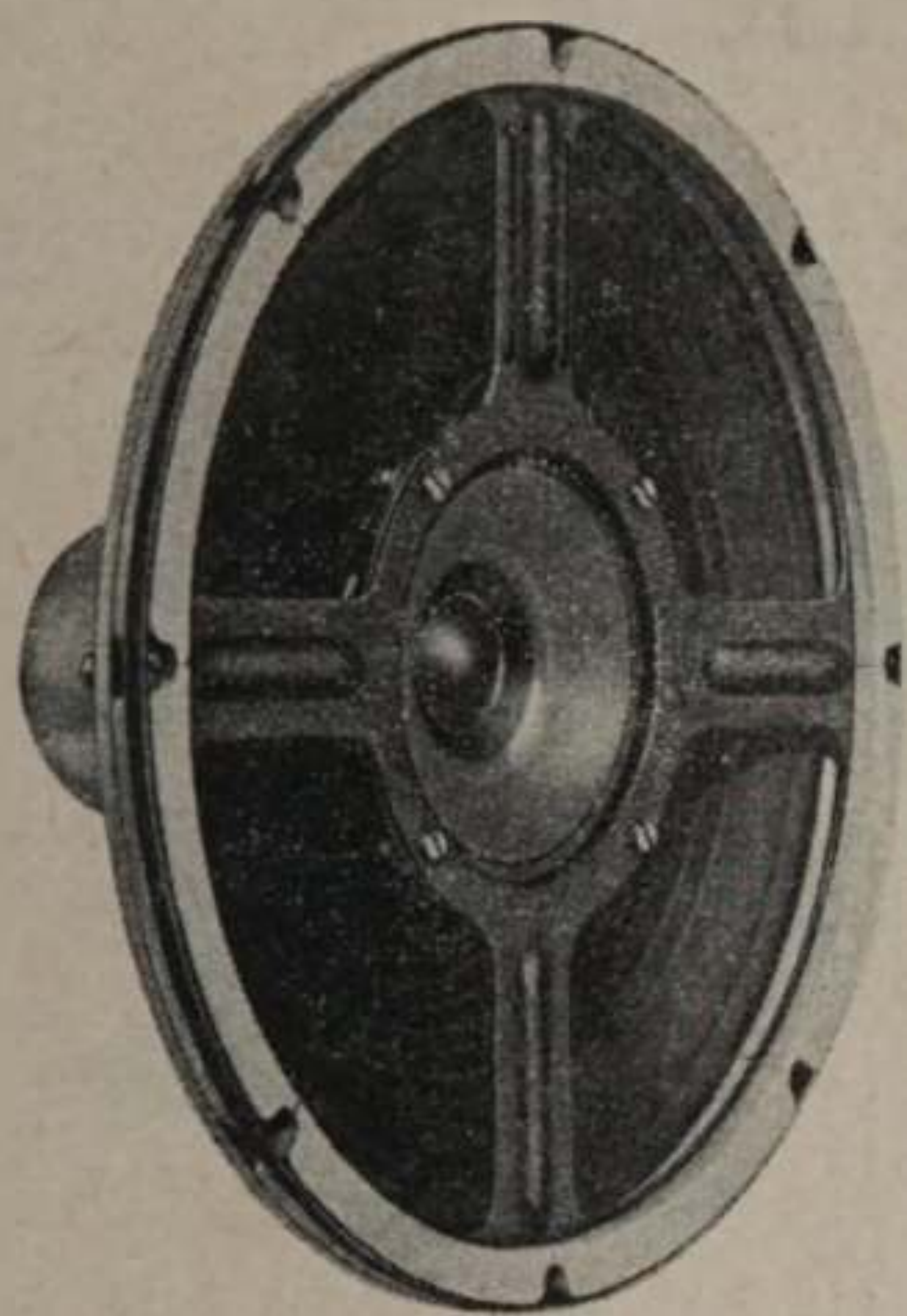


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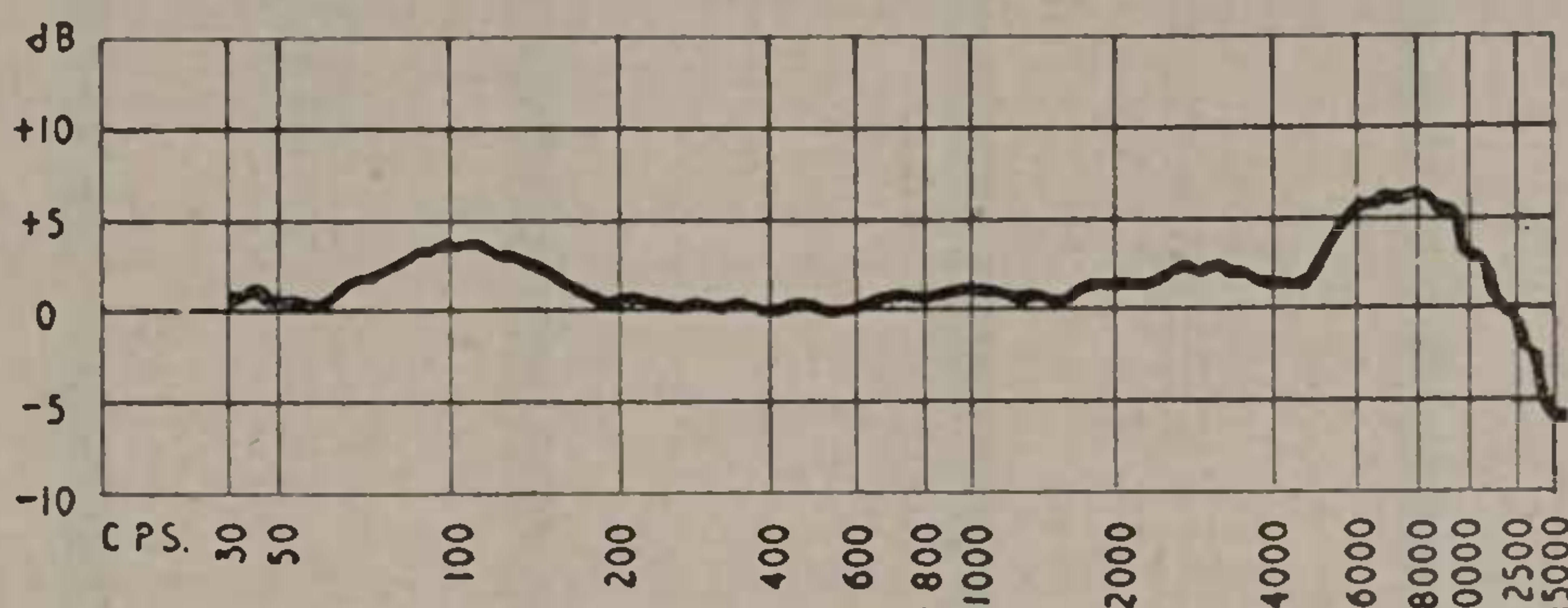
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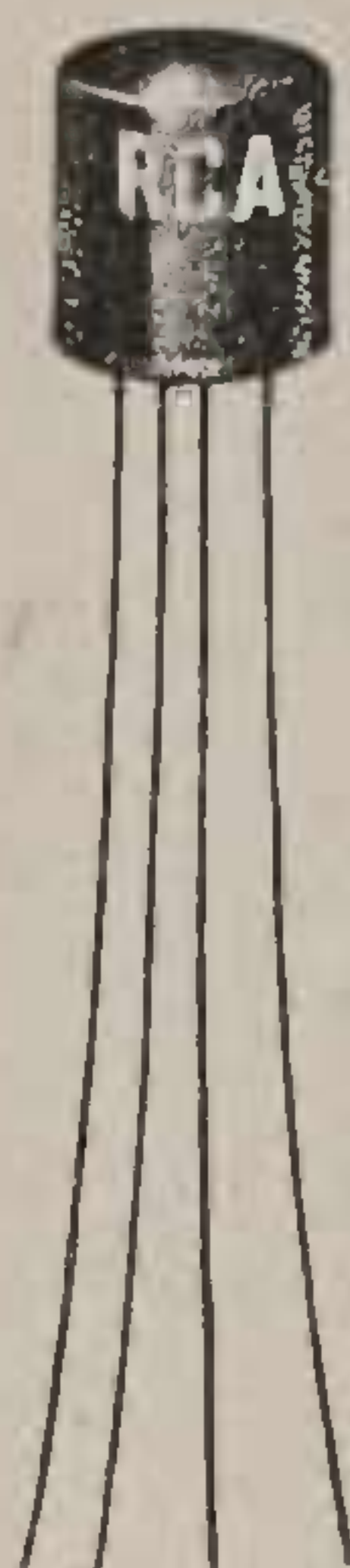
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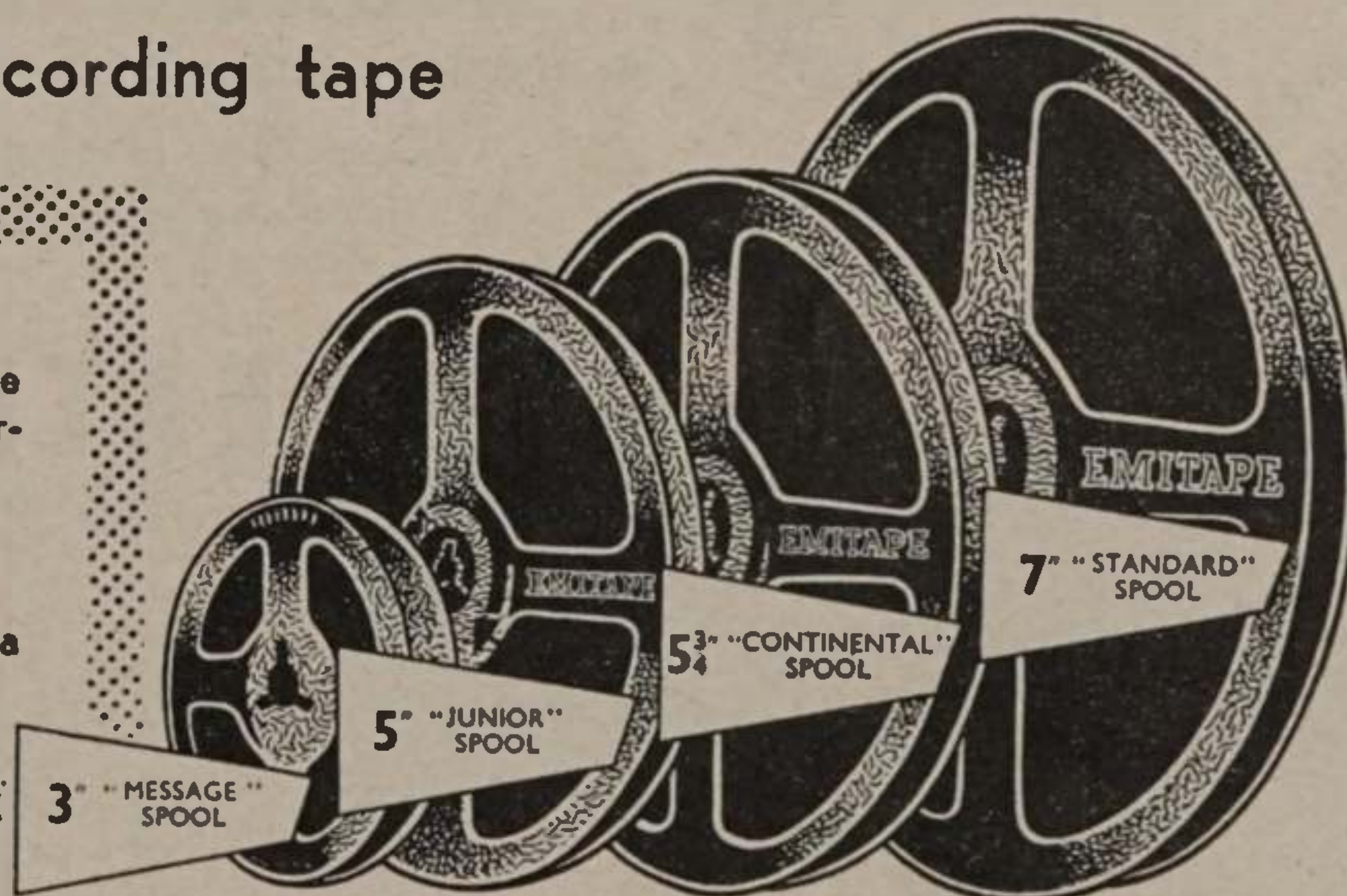
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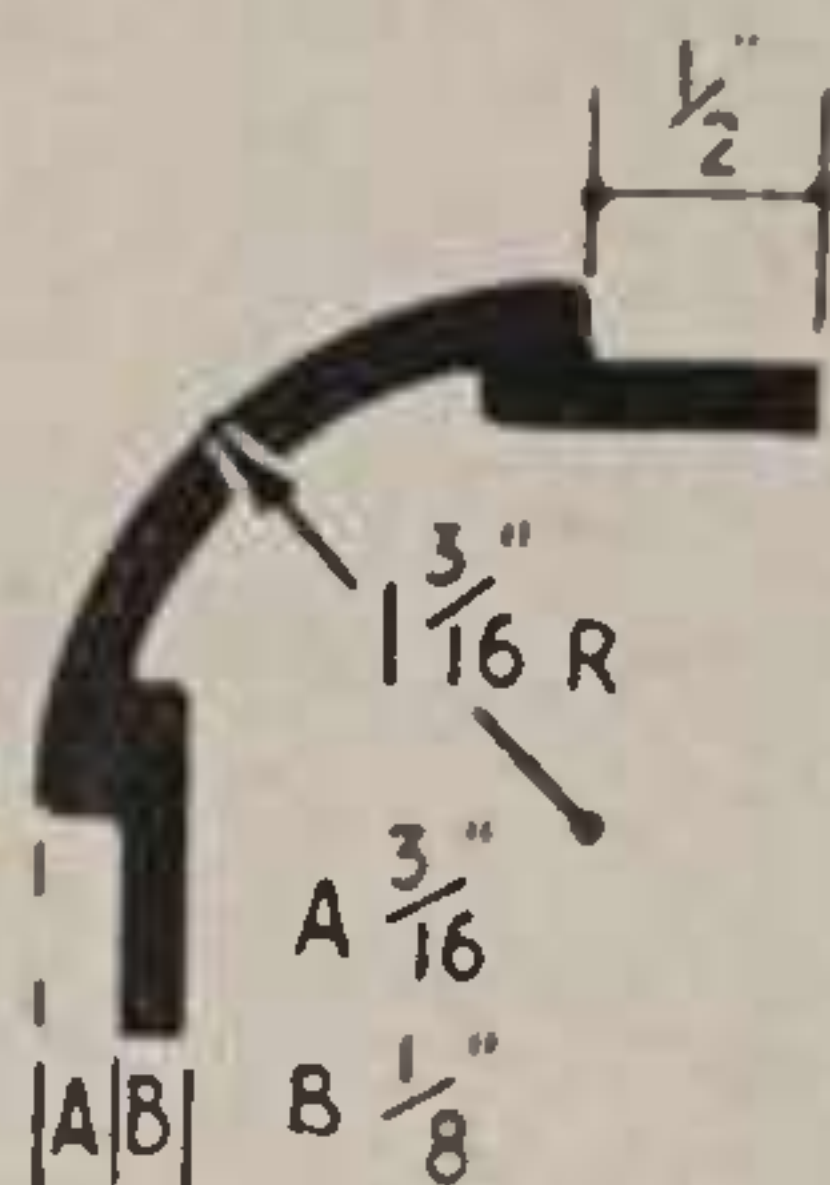
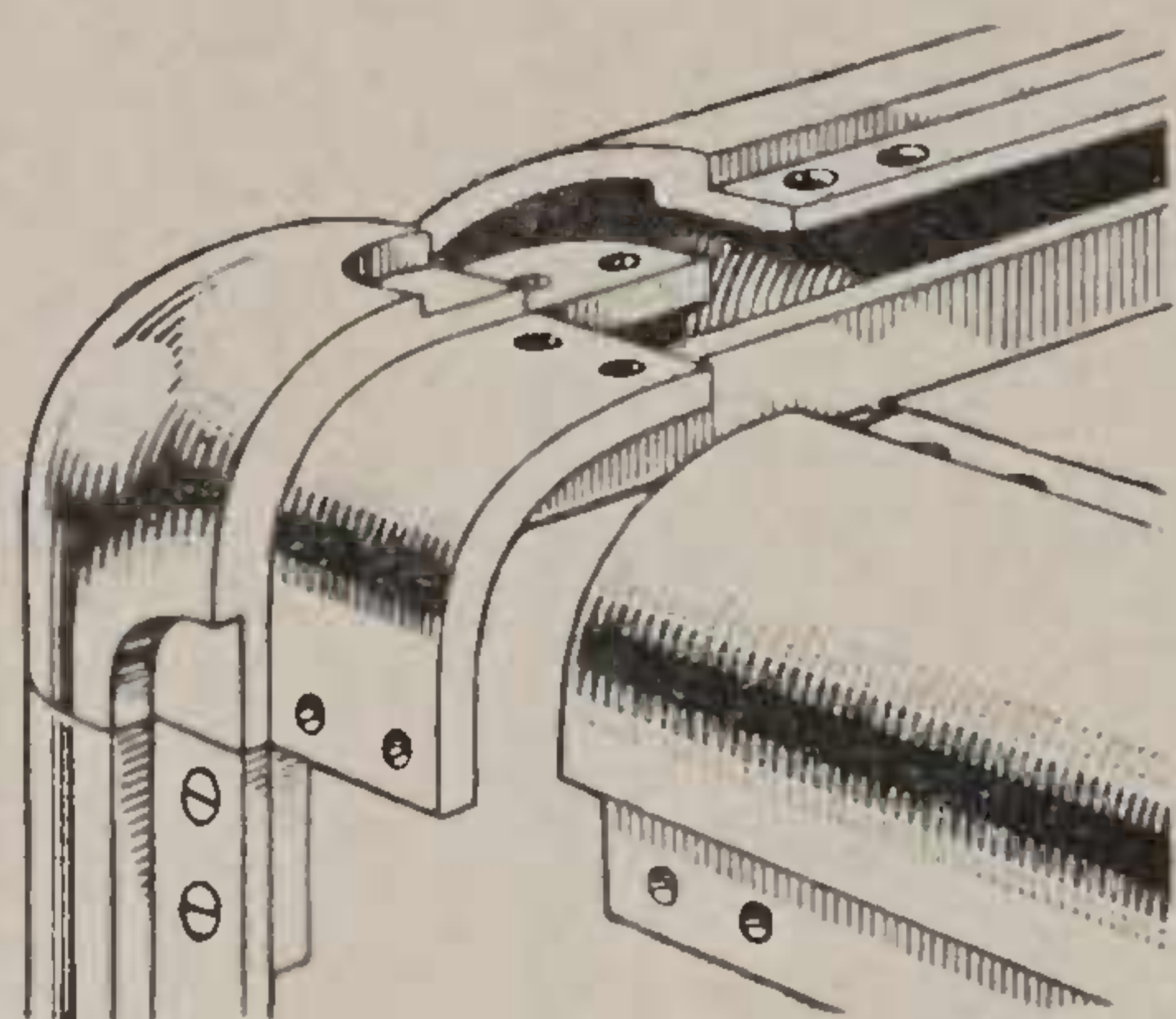
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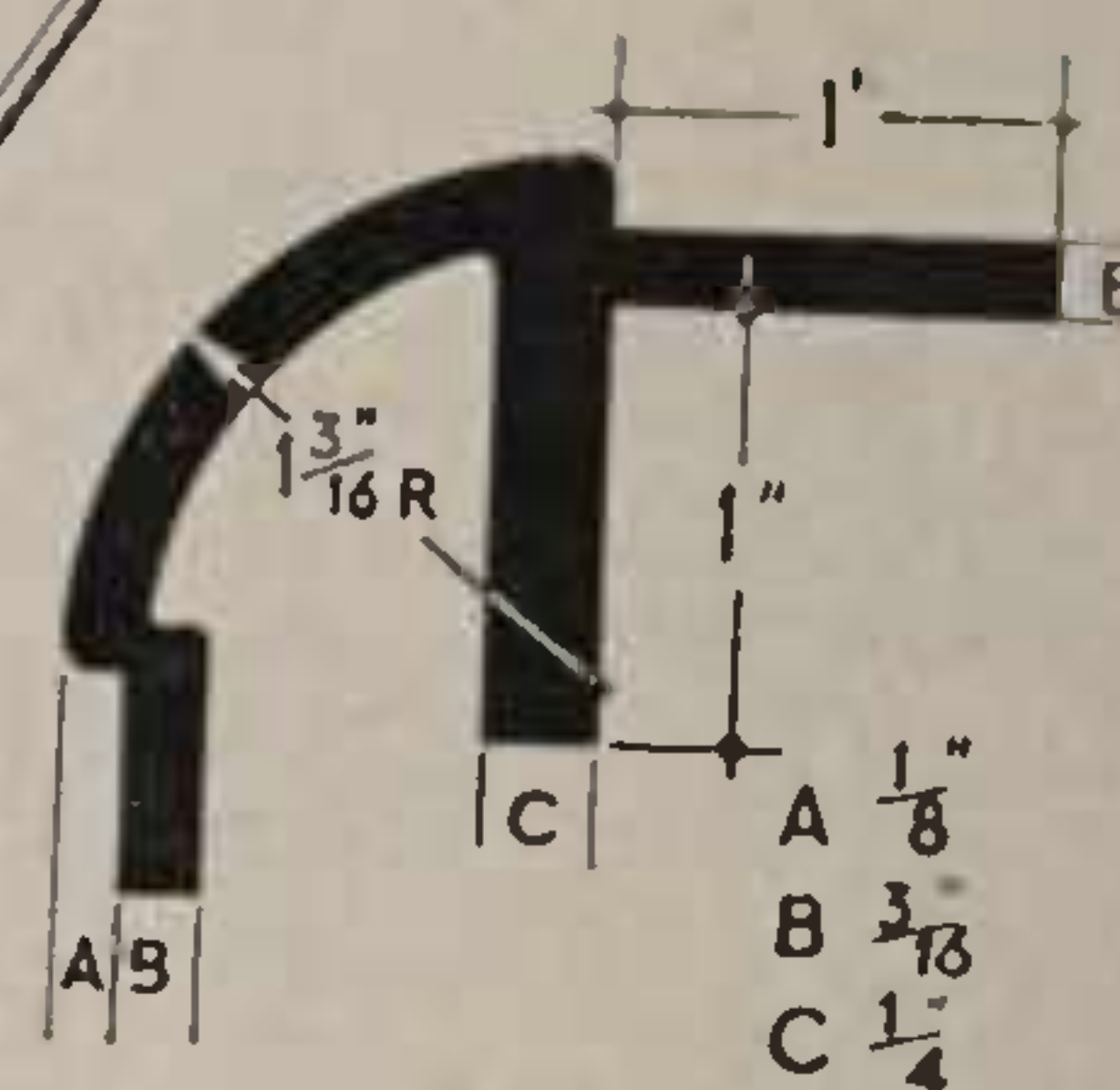
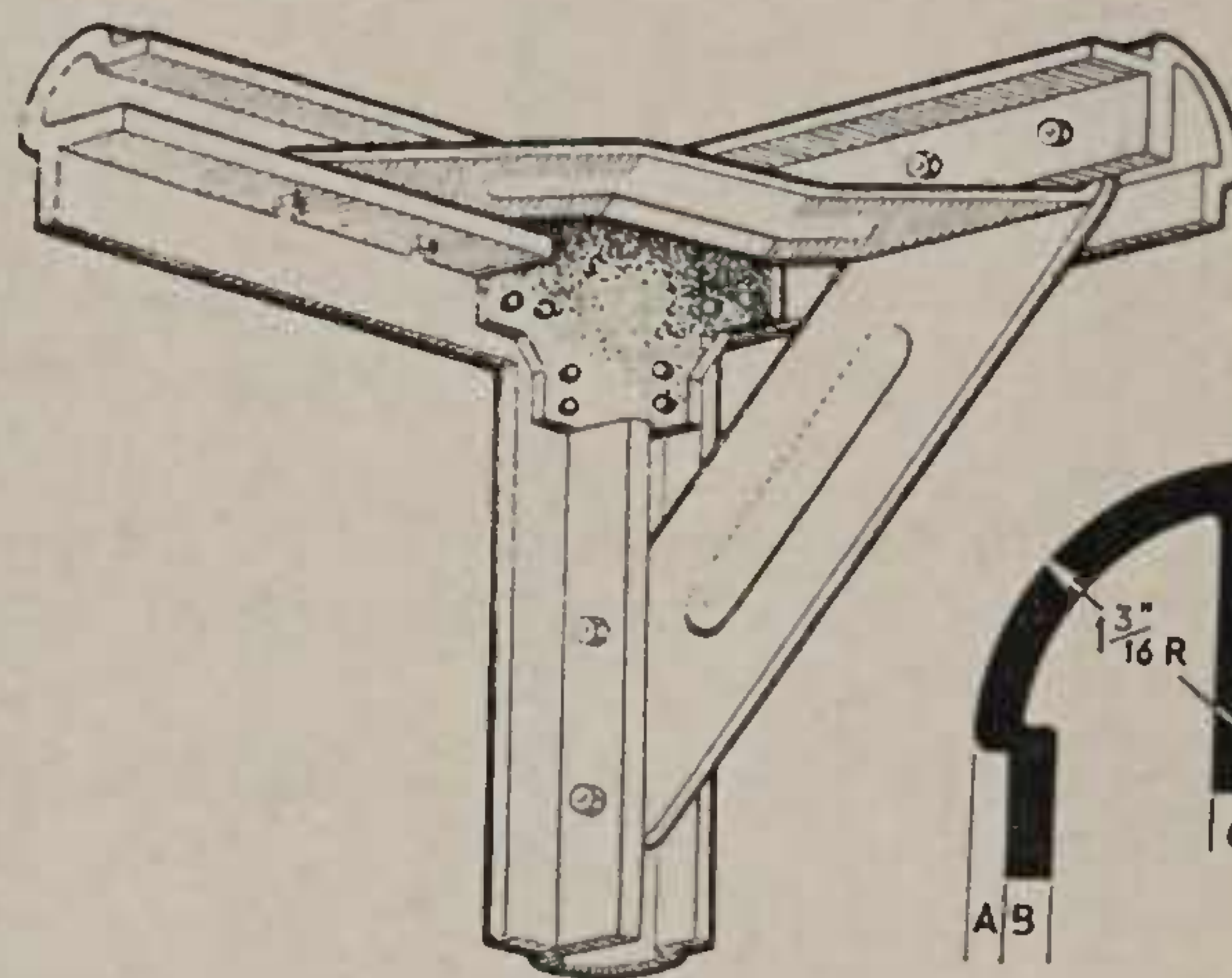
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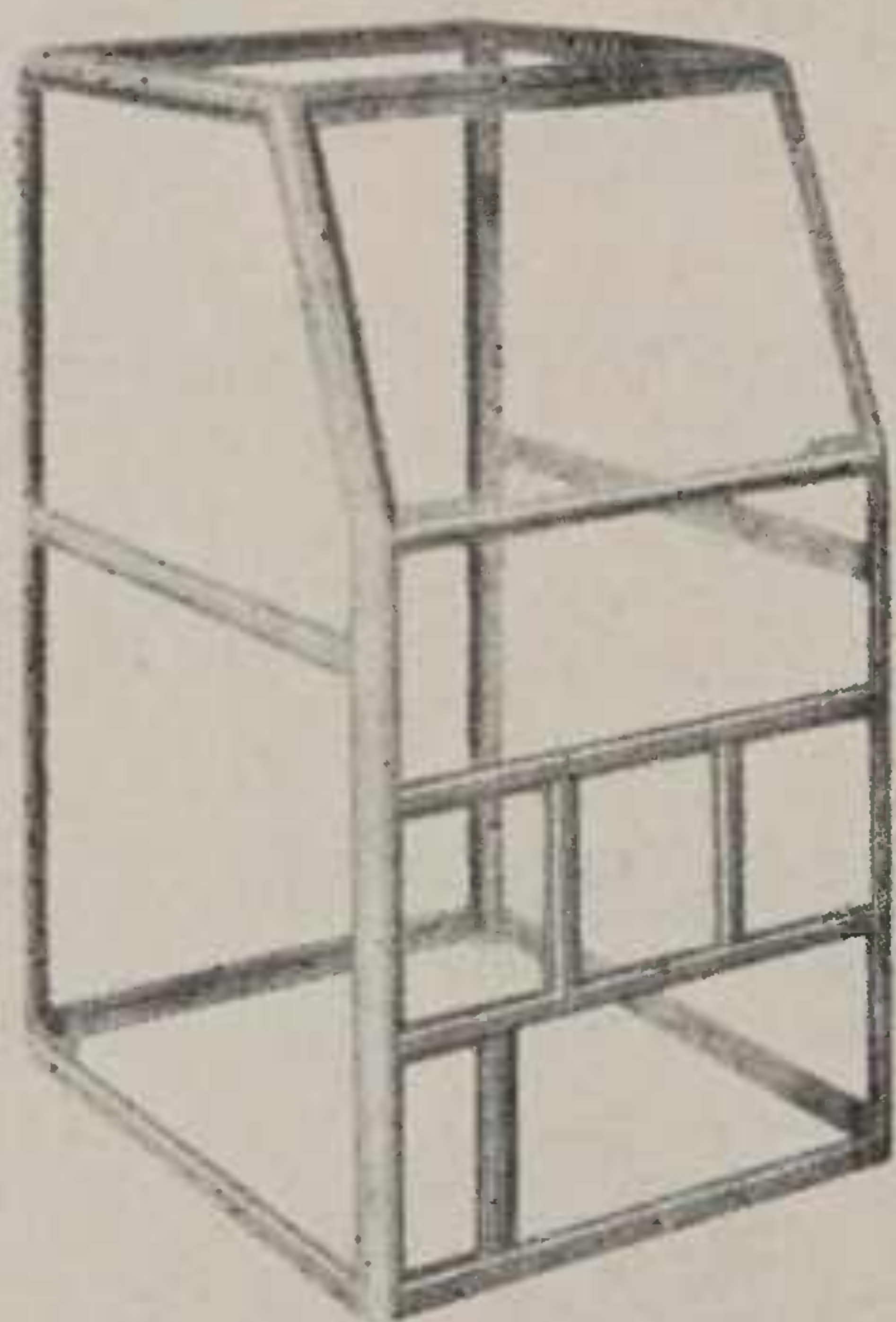


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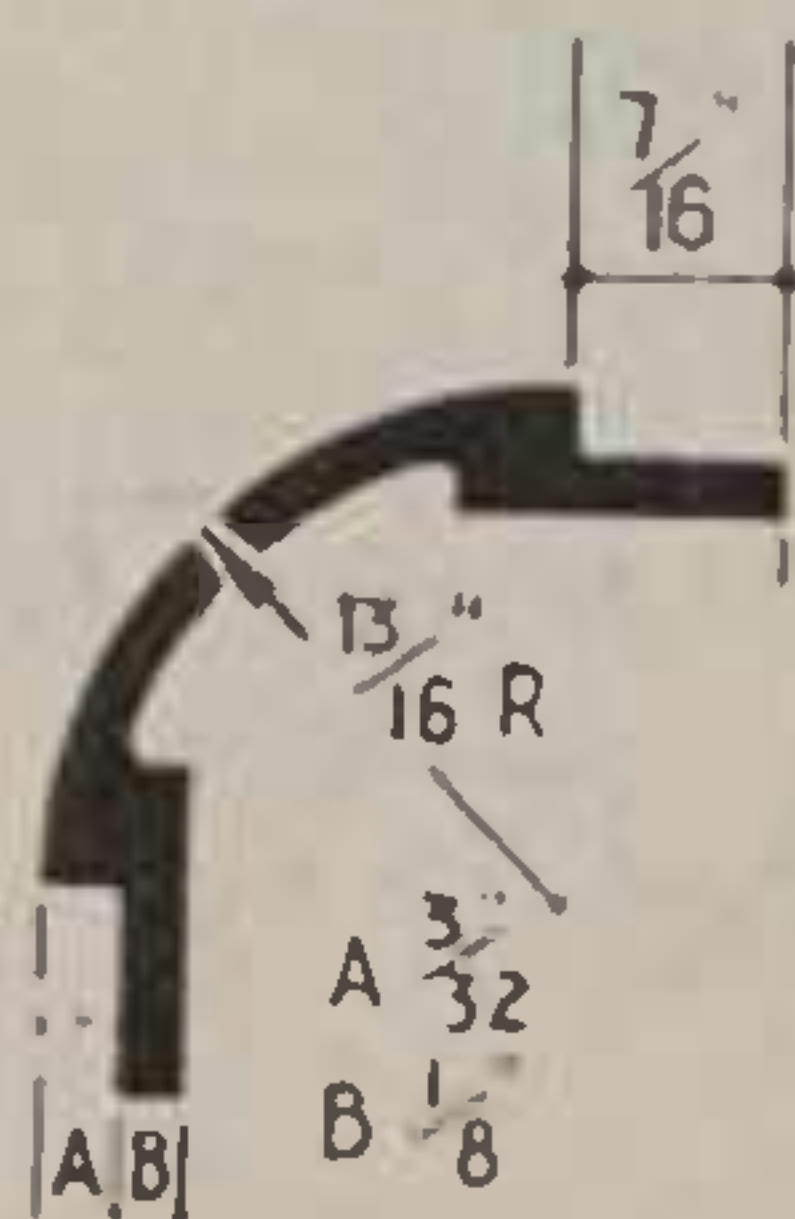
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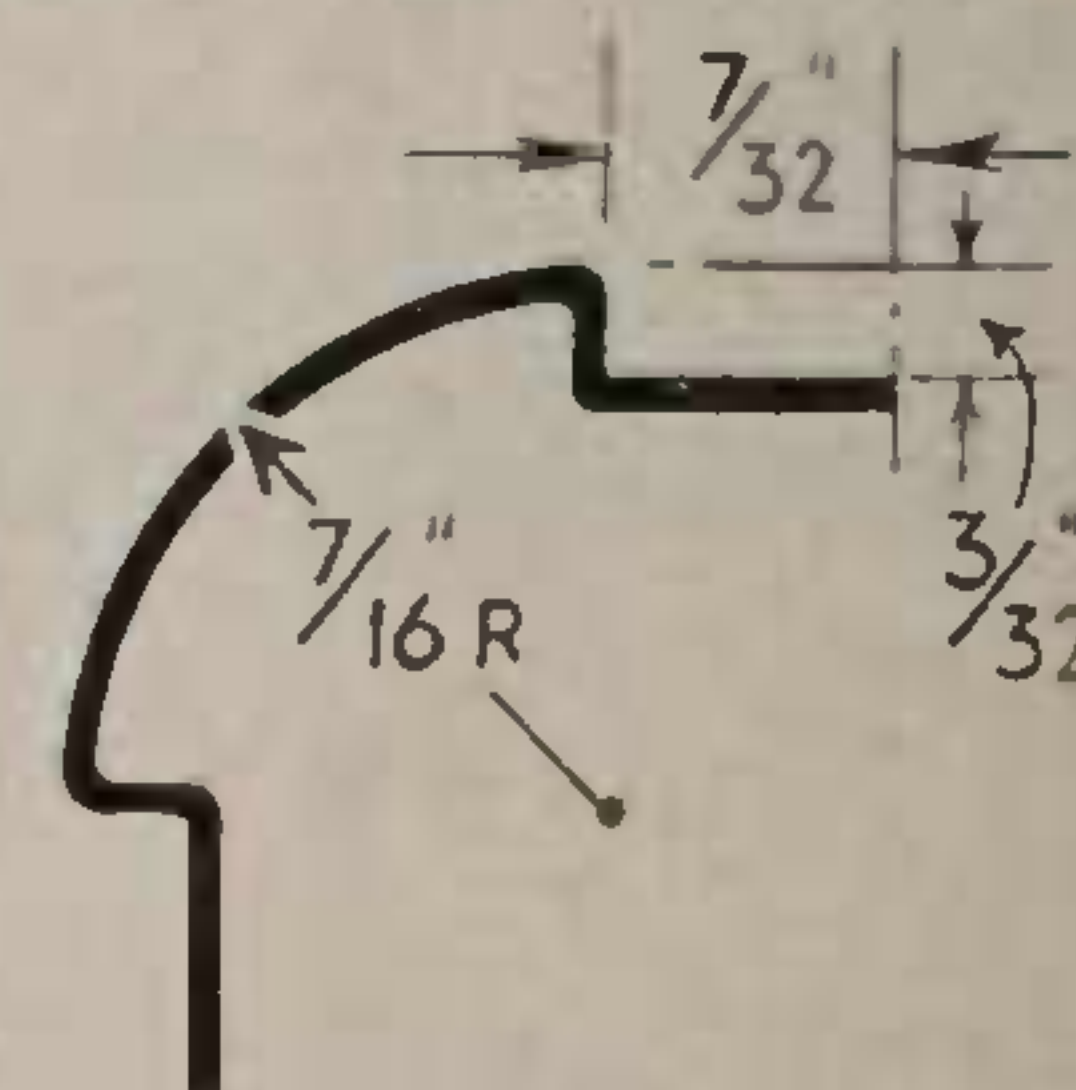
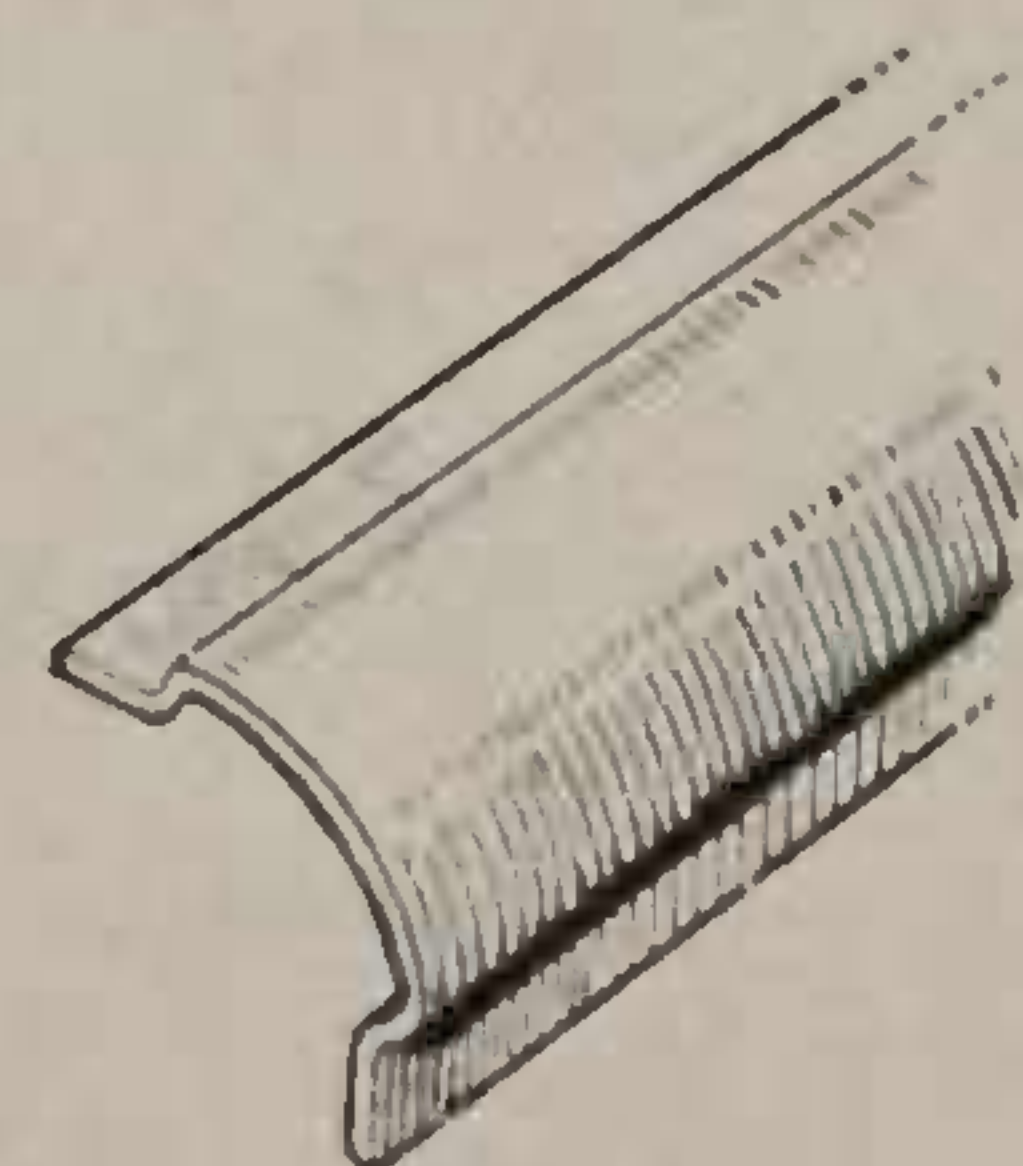
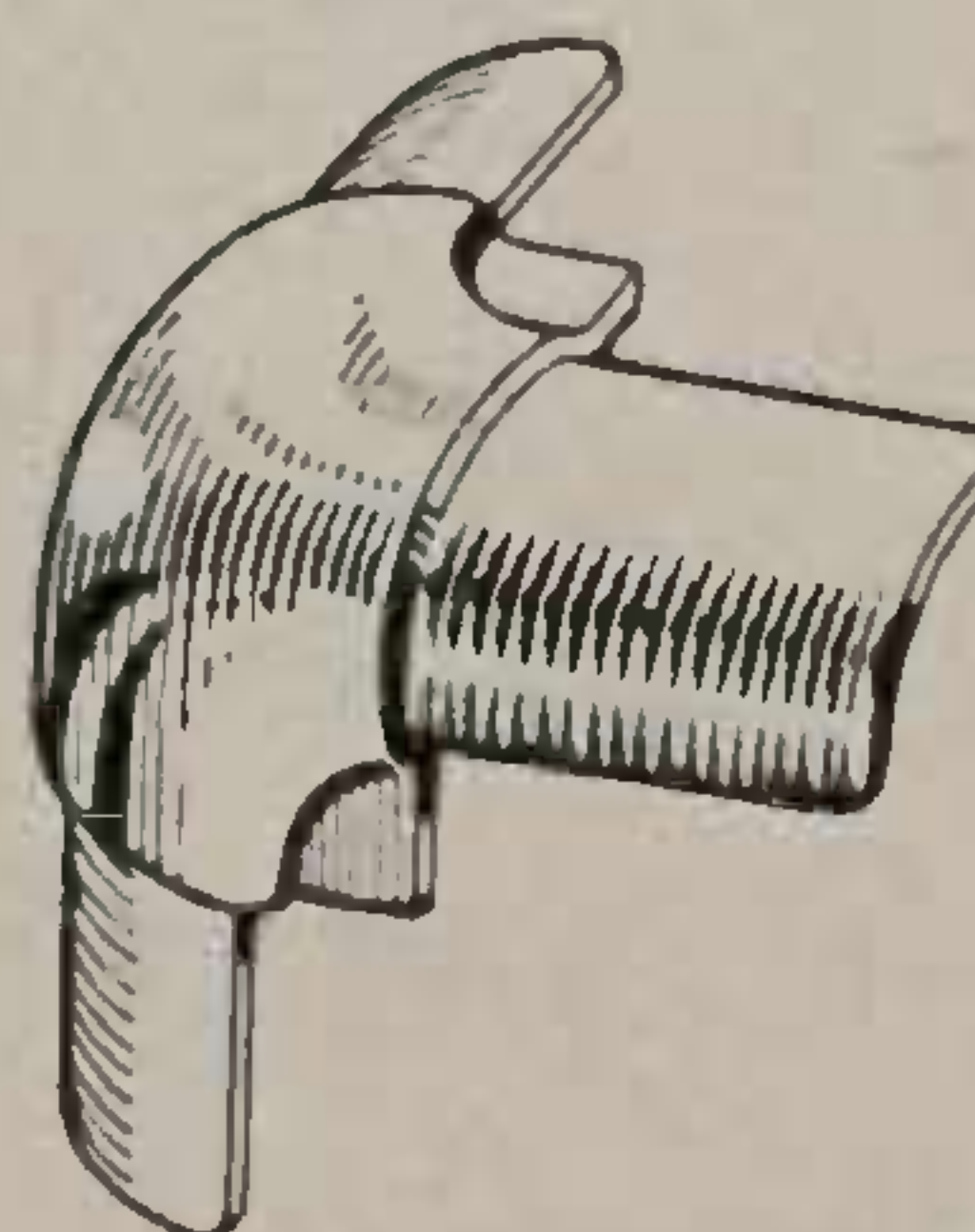
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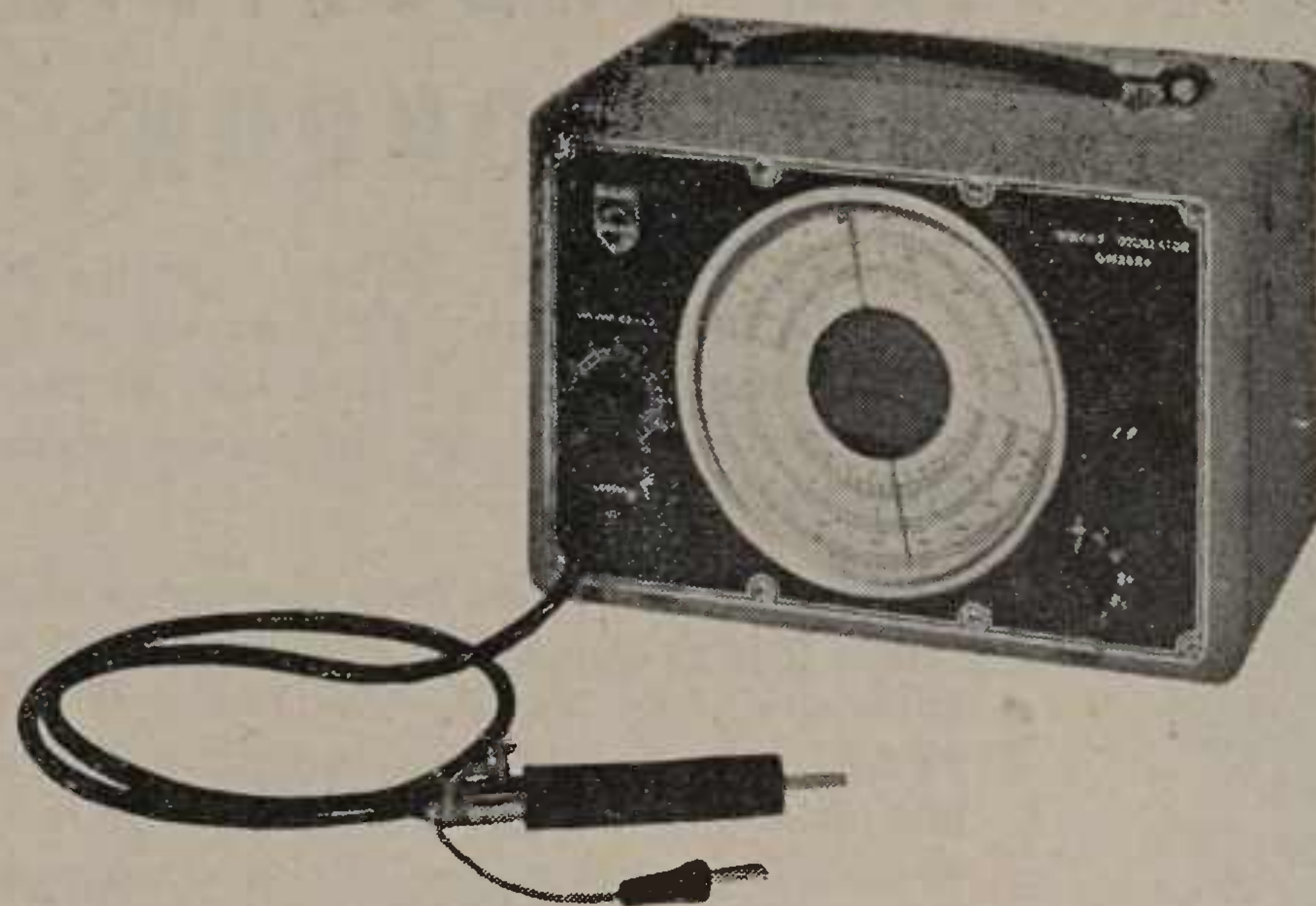
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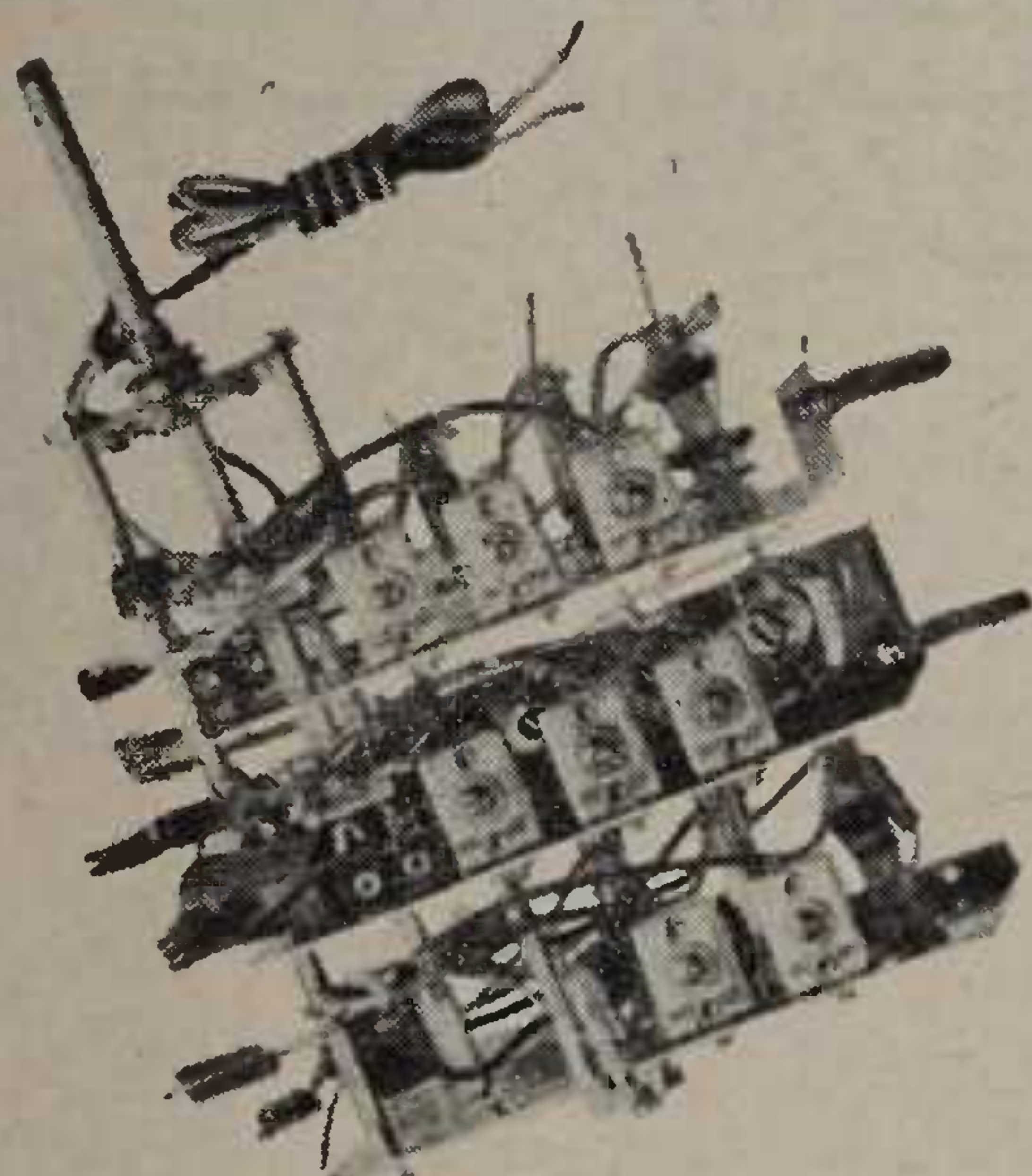
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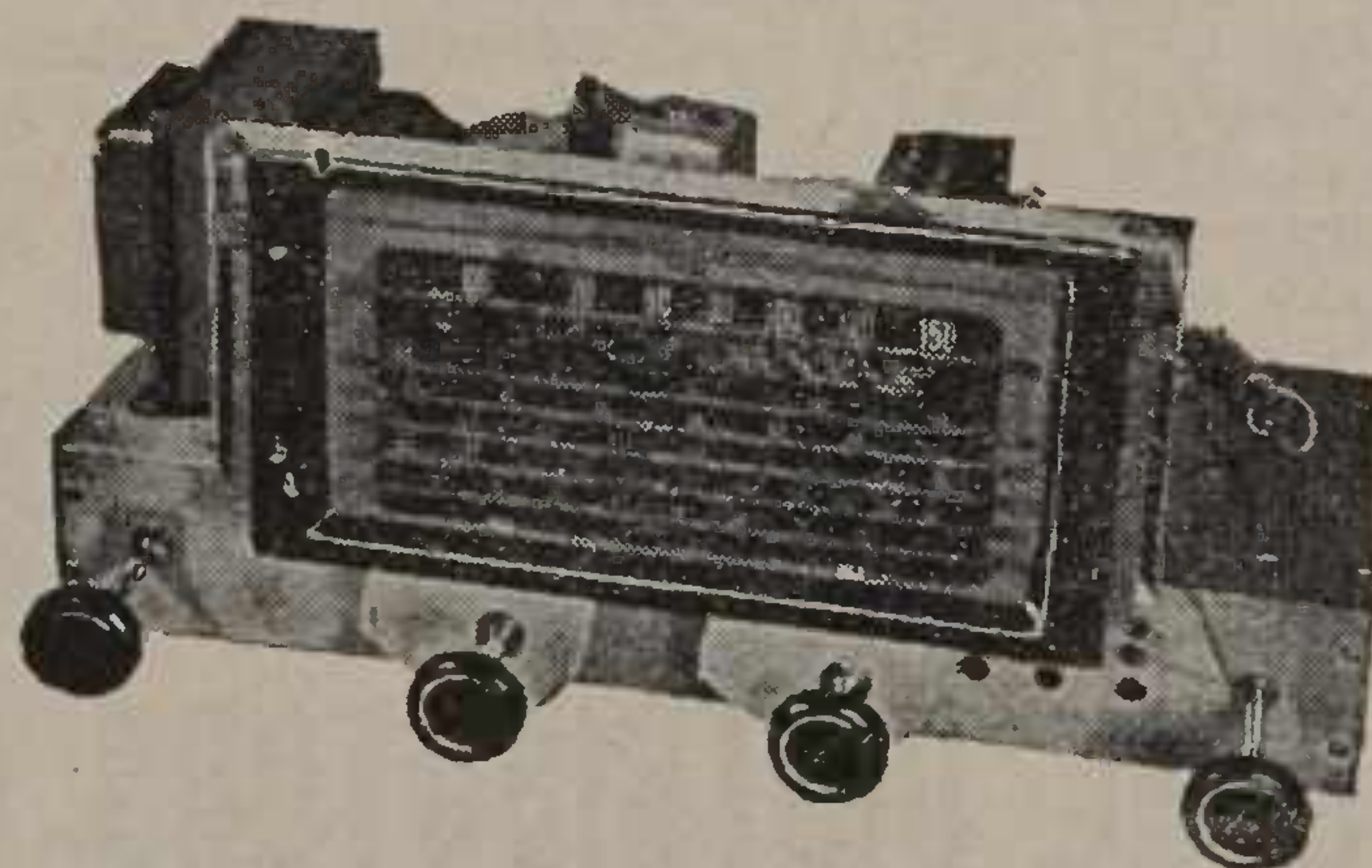
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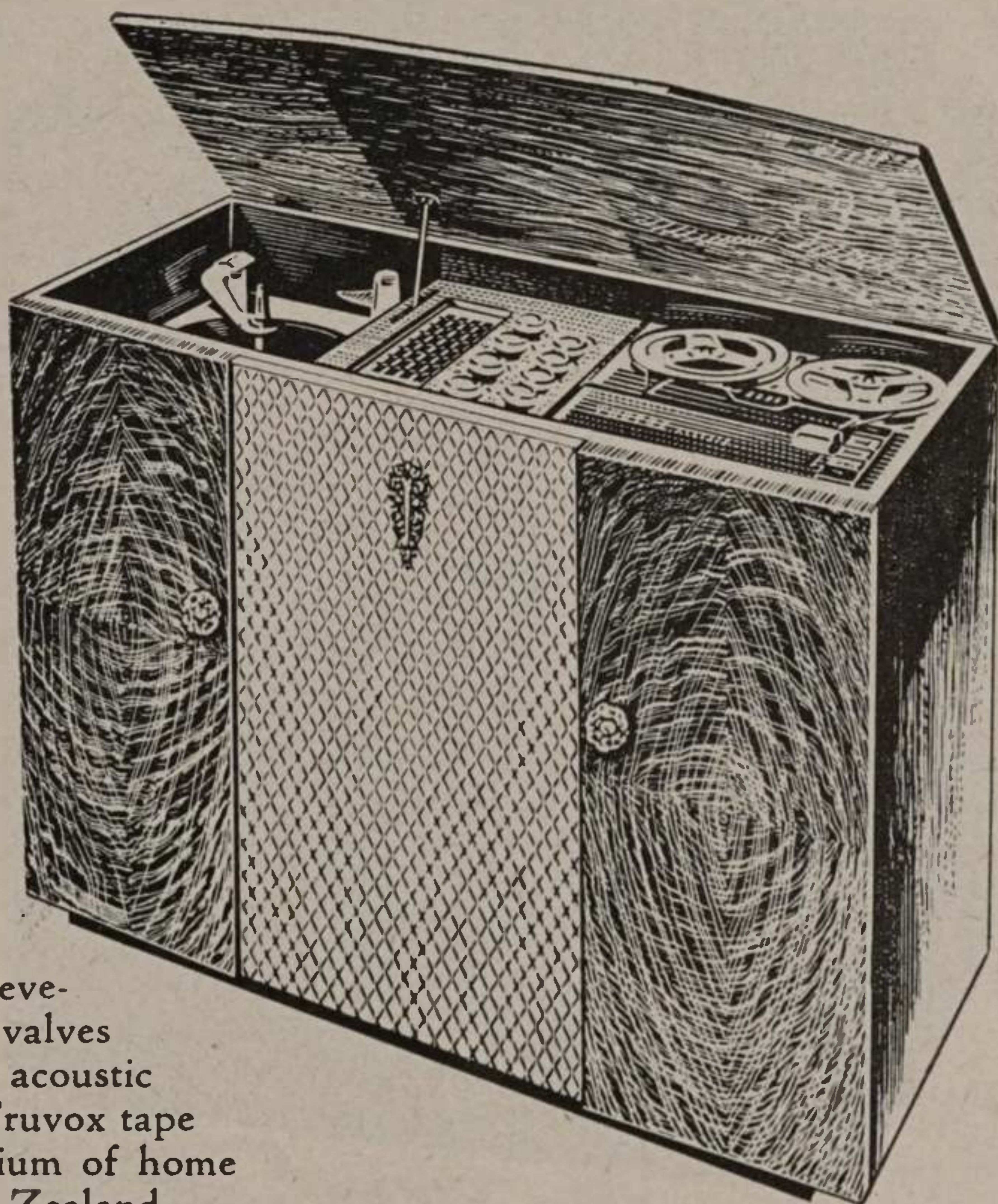
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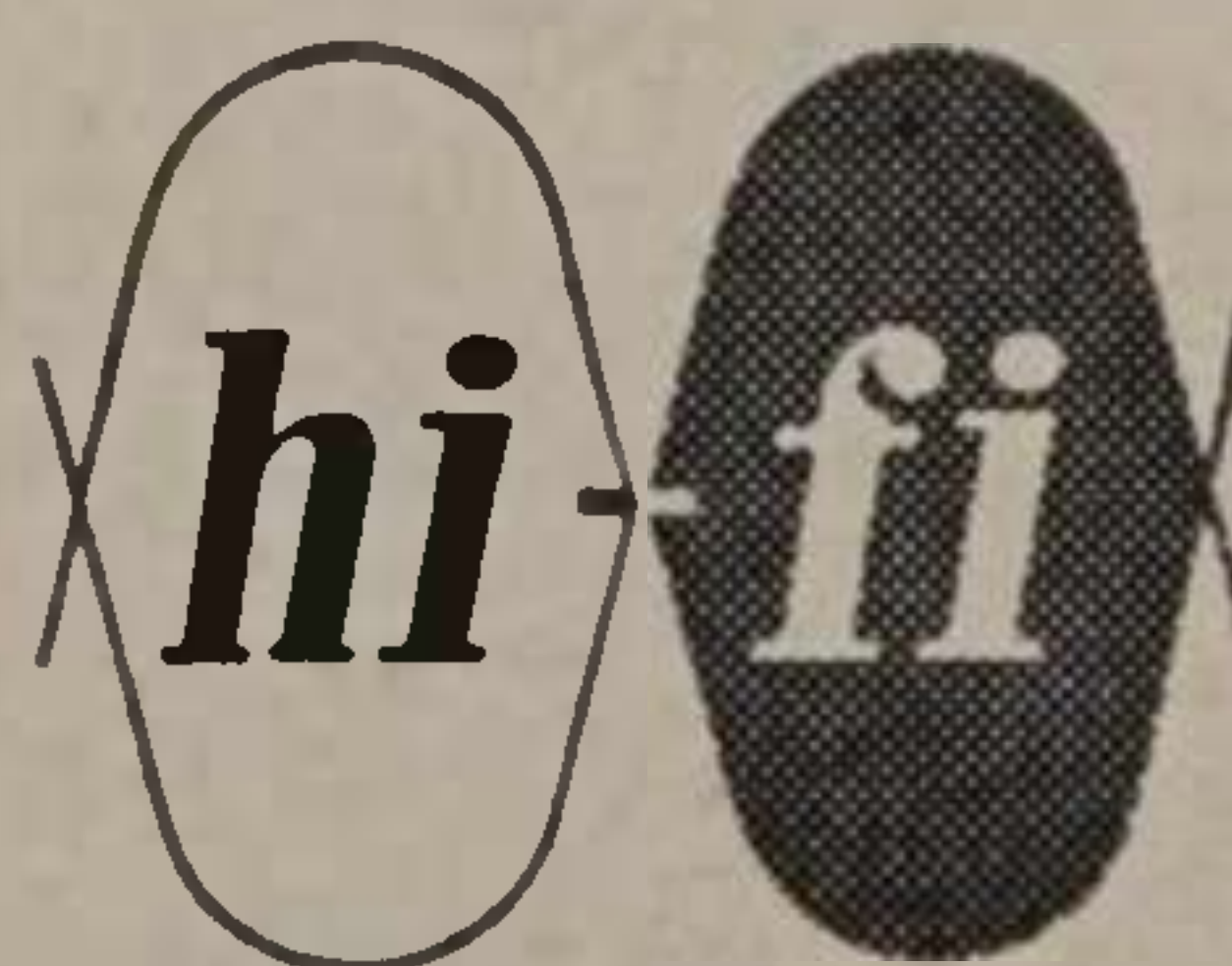
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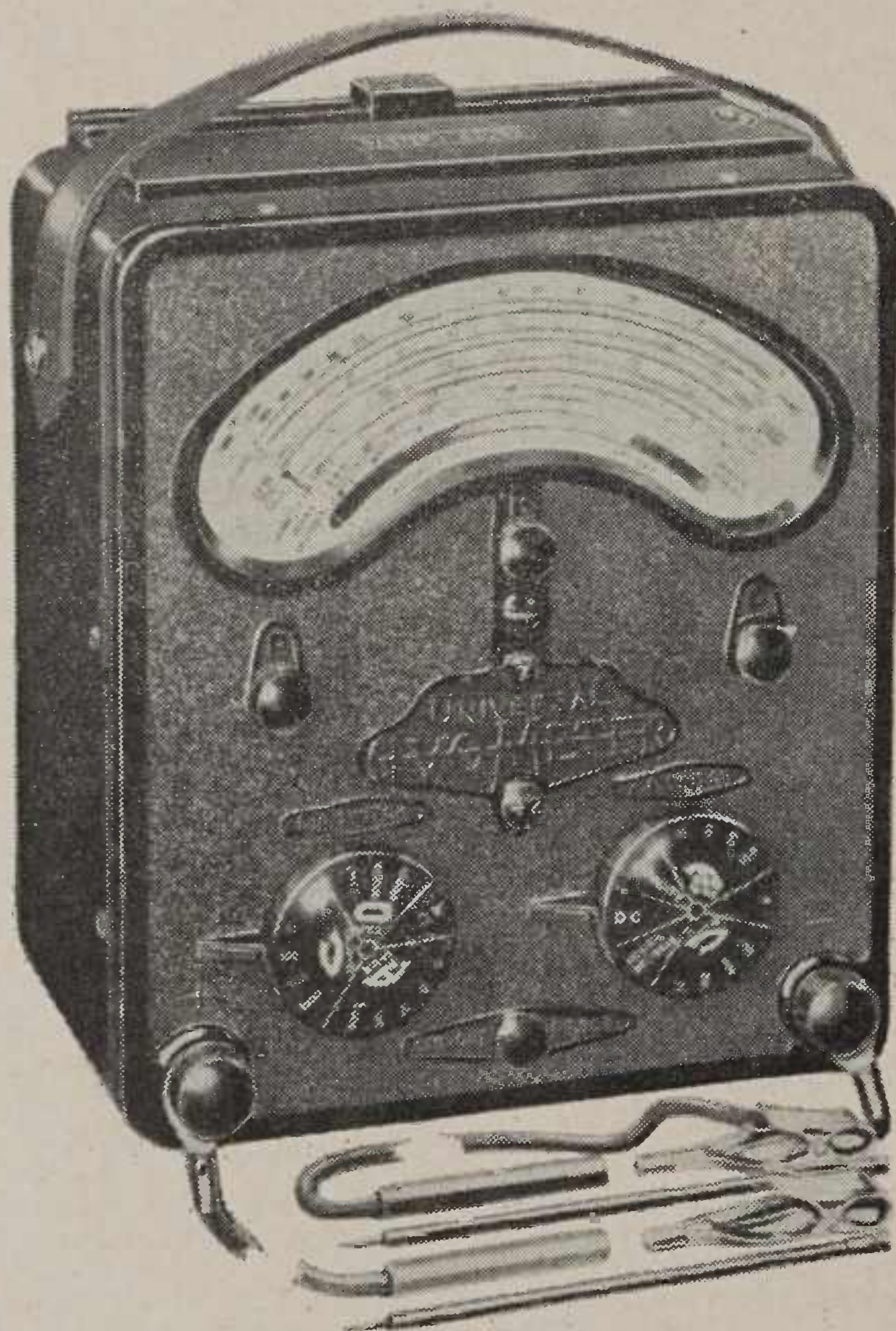


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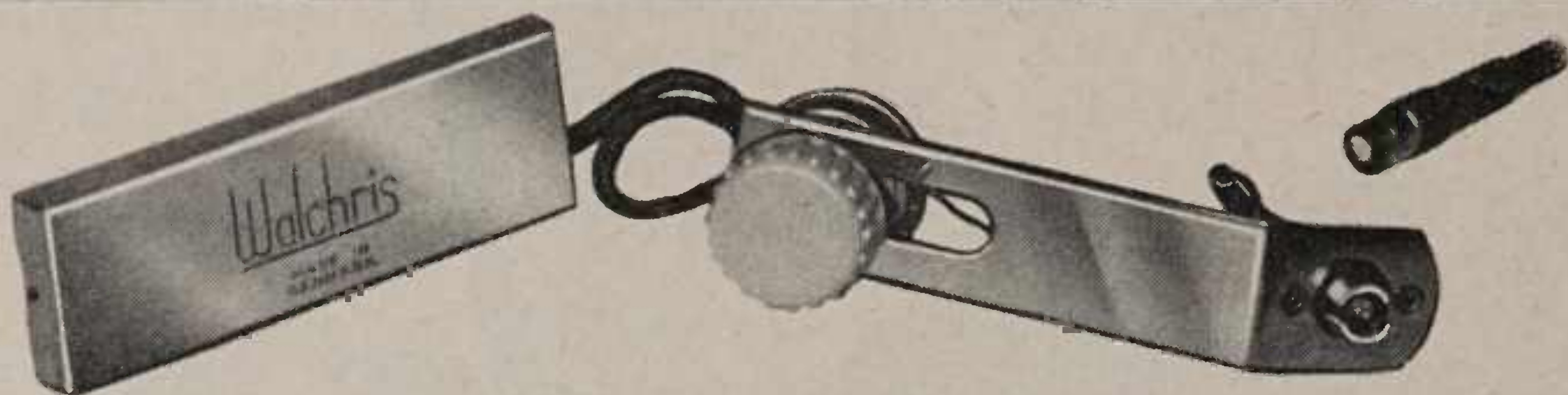
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5-7L	5	F86	115	110-6,000	3.5	7 ³ / ₈ x 5 ¹ / ₈	3 ¹ / ₈	6 ³ / ₄ x 4 ⁵ / ₈
6-9H	4	F70	115	110-5,500	3.5	9 ⁷ / ₃₂ x 6 ¹¹ / ₃₂	3 ⁵ / ₁₆	8 ³ / ₄ x 5 ³ / ₄
6-9L	5	F70	115	110-5,500	3.5	9 ⁷ / ₃₂ x 6 ¹¹ / ₃₂	3 ¹ / ₂	8 ³ / ₄ x 5 ³ / ₄

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PRINCIPLES OF STEREOPHONIC SOUND

Since reporting last month on the demonstrations of stereophonic sound turned on by Mr W. G. Leatham, we have been requested to print an article describing the principles underlying stereophonic reproduction of sound. Since the topic is a live one, we have pleasure in acceding to this request at the earliest opportunity.

Introduction

Those who have never heard stereophonic reproduction, and who have marvelled at the realism obtainable with high-quality reproducing equipment of the conventional kind, might well be excused for asking why stereophonic sound should be attempted at all. However, those whose business it has been to grapple with the problems associated with obtaining lifelike reproduction of music by electrical means have always realized that however highly we may develop microphones, amplifiers, loudspeakers, and all the other paraphernalia of sound reproduction, there is one aspect of our hearing that ordinary reproducing systems can never duplicate. This is the fact that we hear with two ears, and a complex mechanism of the brain, by means of which the two versions of the received sound that are picked up by each ear are combined in such a way as to provide much more information than could be obtained by listening with a single ear. Briefly, then, our hearing is *binaural*. An ordinary reproducing system starts with a single microphone, which is connected to a single speaker by a devious route, which may involve recording, transmission by radio, or both, or which may consist only of a single amplifier. However, since the beginning of the system is a single microphone, the exact mechanism by which its output is carried to the loudspeaker is quite unimportant, since it is clearly impossible to restore to the system what has been lost through the employment of only a single pick-up device.

It is possible, of course, to use two or more microphones, and to mix their outputs in suitable proportions before transmitting their outputs to the loudspeaker, but such a scheme does no more than a single microphone to replace our two ears. This is because each ear has its own separate portion of the brain to which its impressions are fed. In short, "real", or binaural hearing is a two-channel affair. We can imagine the ears each as being a microphone, with its own completely separate amplifying gear, presenting its own version of the received sound to its own part of the brain. The latter, can be regarded as a kind of computer, which is able to work out, from the differences between the two versions of sound presented to it, such things as the direction from which the sound is coming, or whether the source of sound is moving, and if so, in what direction.

So much for the mechanism of hearing; the description given has been very brief and very imperfect, but it does serve to make the main point—namely that listening to a conventional system can never make up for its deficiency of having only one "ear", and

of presenting virtually the same sound to each of our own.

Not at all New

These deficiencies have been realized by engineers for a long time—for much longer, in fact, than most people would suspect. In point of fact, the first man to experiment with binaural reproduction was none other than Alexander Graham Bell, the inventor of the telephone! Writing in 1880, he referred to the "stereophonic phenomena of binaural reproduction", thus bringing in two terms which need to be defined before this discussion can proceed. The following definitions are taken from a paper by W. B. Snow, in the *Journal of the Society of Motion Picture and Television Engineers*, November, 1953. Reproducing systems are defined as binaural or stereophonic, as follows:—

Binaural—"A system employing two microphones, preferably in an artificial head, two independent amplifying channels, and two independent headphones for each observer. This duplicates normal listening."

Stereophonic—"A system employing two or more microphones spaced in front of a pick-up area, connected by independent amplifying channels to two or more loudspeakers spaced in front of a listening area. This creates the illusion of sounds having direction and depth in the area between the loudspeakers."

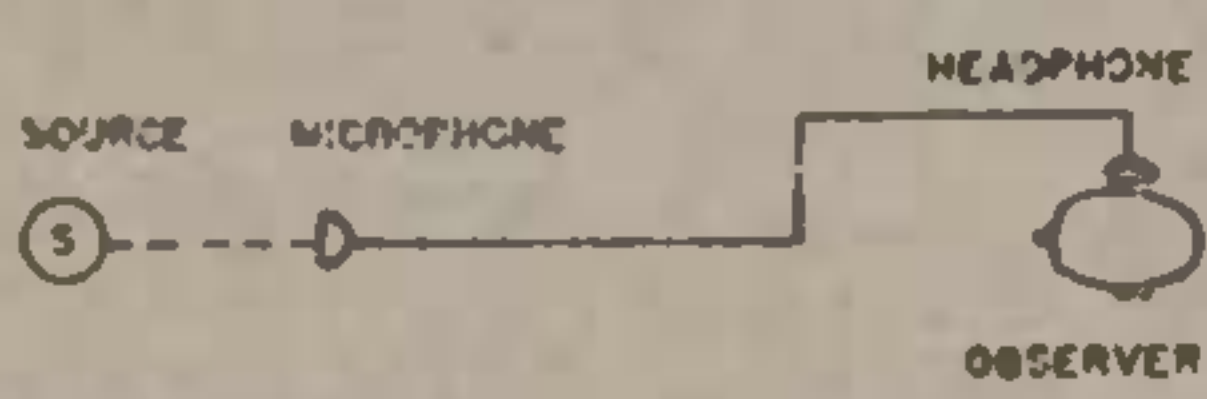
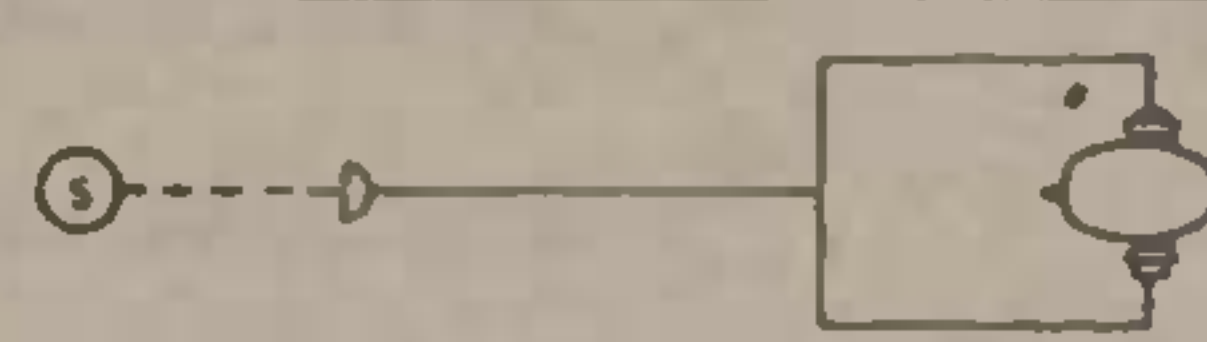
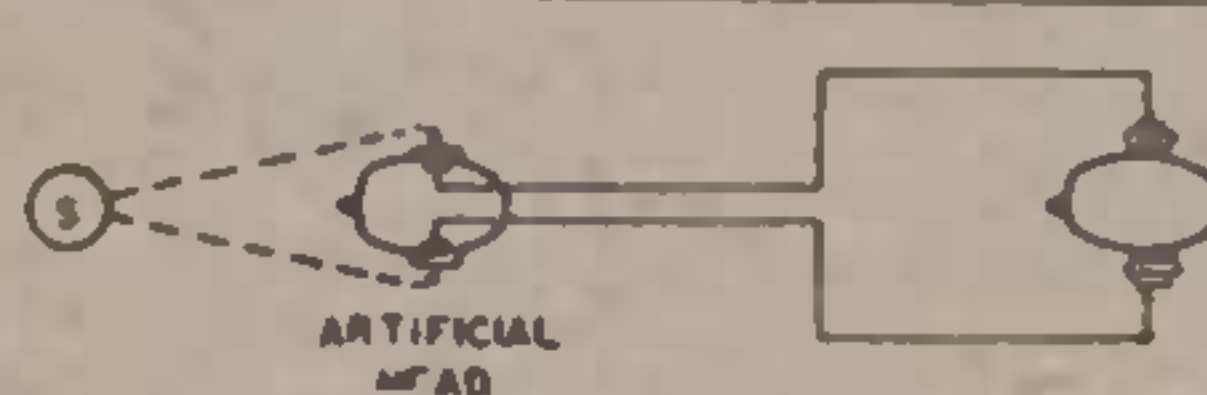
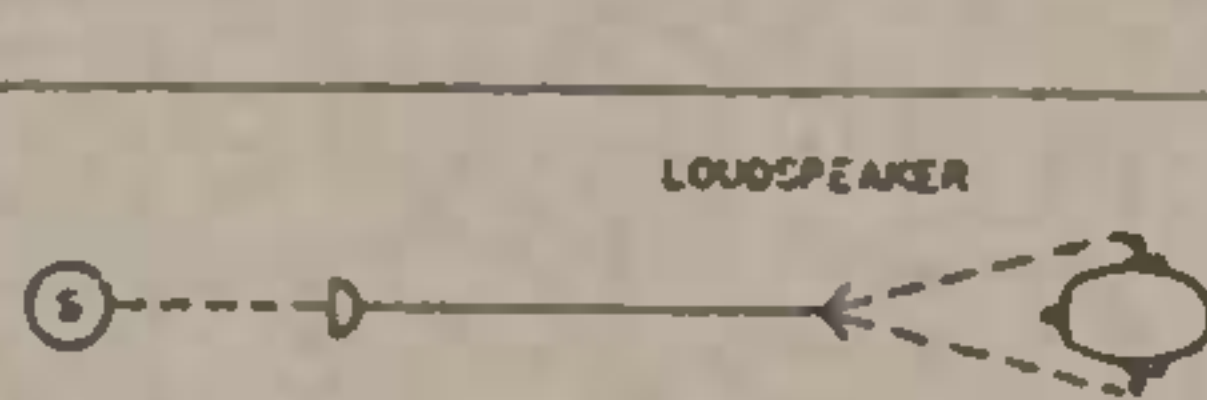
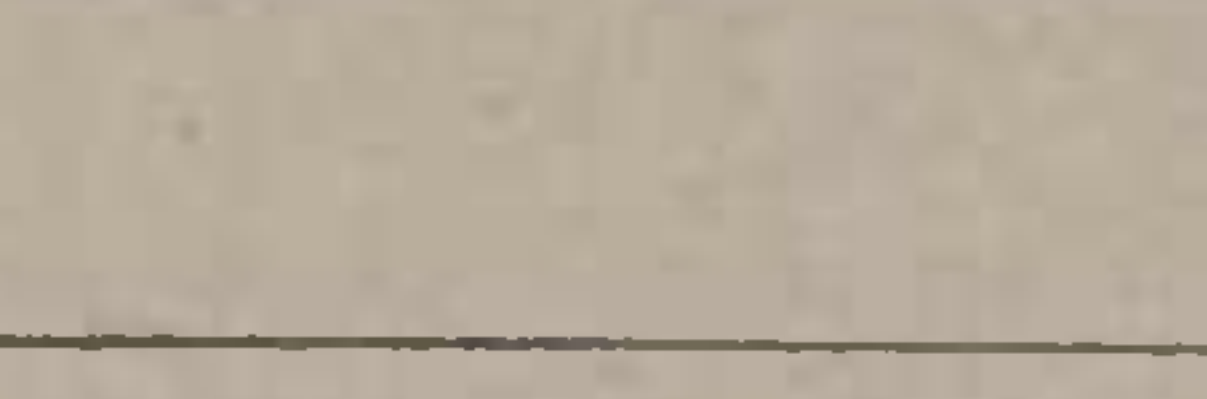
As Snow points out, it is most important to distinguish between these systems. He says "A binaural transmission system actually *duplicates* in the listener's ears the sounds he would hear at the pick-up point, and except that he cannot turn the dummy head, gives full normal directional sense, in all directions. A stereophonic system produces an abnormal sound pattern at the listener's ears which he *interprets* as indicating direction in the limited space between the loudspeakers. It has been aptly said that the binaural system transports the listener to the original scene, whereas the stereophonic system transports the sound source into the listener's room."

Various Systems Possible

There are at least six ways in which an electro-acoustic system can attempt to re-create the original sound. These, and their characteristics are outlined in the accompanying table, after Snow.

"Equivalent Normal Experience" refers to the every-day hearing experience that most closely parallels listening by means of the systems in question. The column "Direct Sound Reproduction of Single Source

Fig. 1. Electro-acoustic sound reproducing systems.

Type of system	Equivalent normal experience	Pickup	Number of channels	Reproducer	Symbolic schematic	Direct sound reproduction of single source pulse	Remarks
Monaural	One ear plugged	1 Microphone	1	1 Headphone		1 Pulse to 1 ear	Only partial equivalence, as directional effects are not duplicated
Diotic	Sound source in median plane only	1 Microphone	1	2 Headphones		1 Pulse to each ear 0 time difference No quality difference	Only partial, as directional effects of elevation not duplicated. No directional effect of room reverberation. Qualitatively much superior to monaural
Binaural	Normal listening, head stationary	2 Microphones in artificial head	2	2 Headphones		1 Pulse to each ear 0 to 0.6 msec time difference Normal quality differences	Directional and quality effects of normal listening in pickup room duplicated throughout 360° sphere. No listening room effects. Observer cannot turn to face virtual source
"Monophonic" ordinary loudspeaker	Sound coming through a hole in a wall	1 Microphone	1	1 Loudspeaker		1 Pulse to each ear 0 time differences No quality differences	Both ears used—binaural listening to a single fixed sound source position. Composite of pickup and listening room acoustics. Listening room reverberation has directivity. Represents widely spaced "effects" loudspeakers
Stereophonic	None	2 or more microphones	2 or more	2 or more loudspeakers		2 or more pulses to each ear 0 to 30+ msec time differences Complex quality differences	Depends on fusion of multiple pulses by ears. Directional and quality effects of normal listening simulated for a limited angular area appearing as part of listening room. 360° simulation would require a large number of channels. Composite of pickup and listening room acoustics. Reverberation has partial directivity in pickup room, full directivity in listening room. Observer can turn to face virtual source. Time differences from both source and observer positions
Pseudo or bridged stereophonic	None	1 Microphone	2 or more	2 or more loudspeakers		2 or more pulses to each ear 0 to 20+ msec time differences Small quality differences	Single source only. Many properties identical with true stereophonic system. Time differences only from observer position, and detrimental. Identical signal-reverberation pattern from each loudspeaker. Identical quality from each loudspeaker. Many other bridged combinations possible

Pulse" is probably the most important, since it gives the basic differences between the sounds produced by the various systems. If a single sound pulse is produced by the source, this column gives the characteristics of the resulting *direct* sound pulses at the observer's ears. The direct sound is the sound transmitted directly from source to observer by the shortest path, and arriving before any reflected sound arrives. It has been found that it is the direct sound that carries the information that makes angular perception of the source possible. Reverberant sound, on the other hand, arrives from many directions and confuses the directional perception, if too great in intensity. The "Remarks" column gives qualifying comments concerning the sound reproduction of each system.

Binaural Reproduction

In order to explain properly the manner in which stereophonic reproduction produces the illusion of binaural listening, it is first necessary to know how binaural listening itself works.

For complex sounds, such as music, binaural listening enables the observer to locate the direction of the source by means of two things—the difference in the arrival time of the sound at the two ears, and the difference in quality heard by the individual ears. It is the arrival time difference which is used by the

sense of hearing to determine the angular position of the source of sound. The ability to turn the head assists in this, because it appears that we can estimate with considerable exactness when the arrival-times of the sounds heard by the ears are equal. Measurements have shown that it is possible to notice differences in the angle-of-arrival of impulsive sounds, such as clicks or speech, to within about one or two degrees. These angles correspond to arrival-time differences of only 10 to 20 μ secs, while the maximum possible difference (i.e., for a source in line with the ears) is only some 700 μ secs.

This is why we likened the brain to a computer: a single ear cannot distinguish such short time intervals, which shows that the brain must be responsible for interpreting the arrival-time differences observed by the ears.

The arrival-time effect is assisted by the differences in the quality of sound arriving at the ears. At low frequencies, this effect is quite absent, because no quality difference is possible in this region. At high frequencies, the effect is greatest, because at these frequencies, the distance between the ears is several wavelengths. Thus, the ear remote from the source will hear sound that is deficient in high frequencies compared with the other, because of the well-known property of sound waves whereby they find it difficult

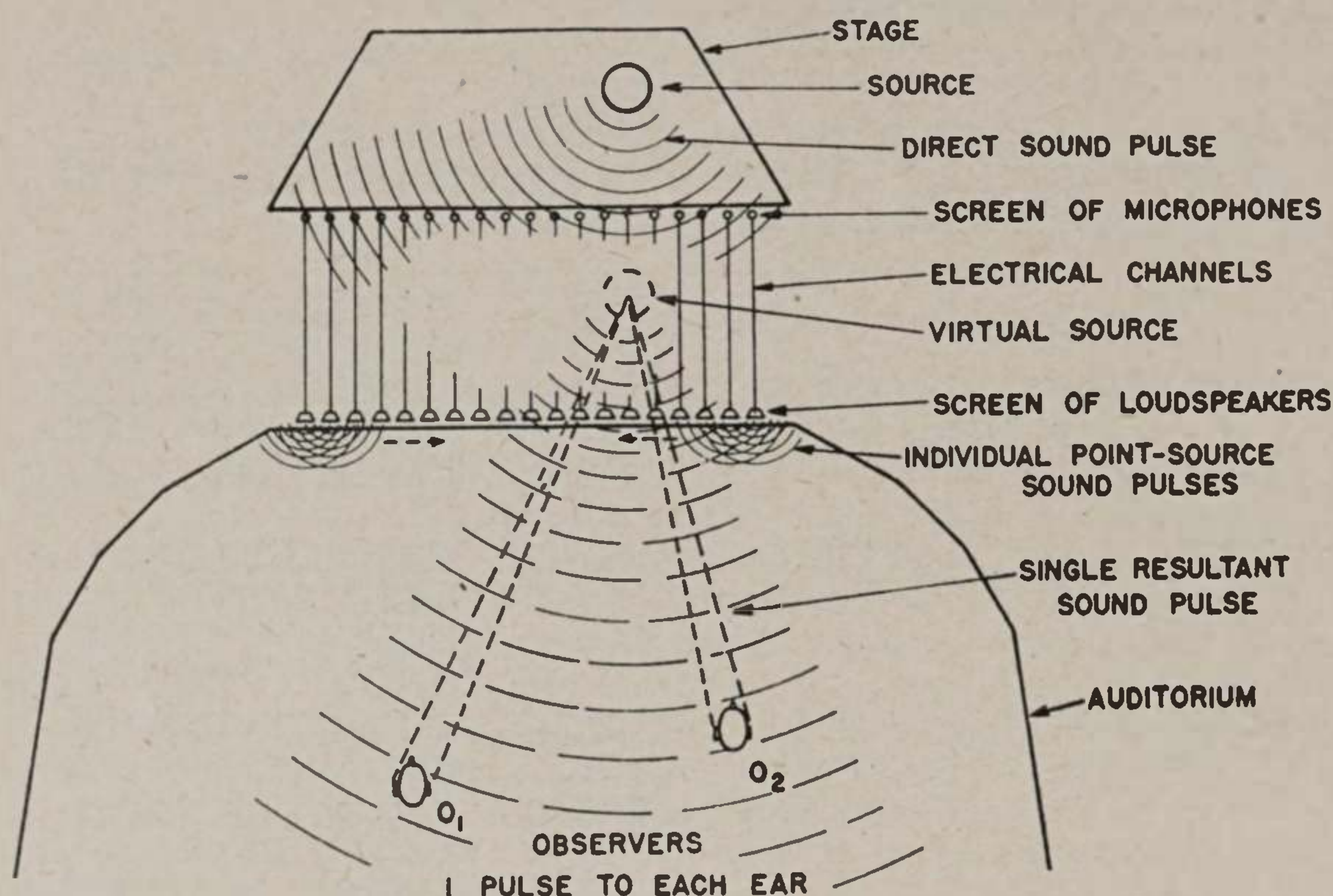


Fig. 2. Ideal stereophonic system. A very large number of very small microphones and loudspeakers would give a perfect reproduction of the original sound.

to diffract, or bend round an obstacle that is large compared with the wavelength. At low frequencies, the distance between the ears is small compared with a wavelength, so that the sound has no difficulty in bending round the head and affecting the "sheltered" ear.

The effect of quality differences is necessary to the proper perception of direction, because if there were only the arrival-time difference to go by, we would find that ambiguities were present. That is to say, more than one direction is able to give the same time-difference, so that some means of resolving this difficulty is needed. The effects of quality differences at the two ears are so complex, that there is only one type of difference corresponding to a given direction, for a given sound.

From this description, it is easy to see that a binaural reproducing system is able to duplicate quite readily, the sounds that would be heard by each ear, if the listener were actually in the position occupied by the artificial head, with its two microphones for "ears". Unfortunately, a true binaural reproducing system absolutely requires headphones for each listener. This not only makes it difficult to provide a binaural system for more than a very few listeners, but has the great disadvantage that very few people would put up with the inconvenience of headphones, which themselves give an air of artificiality to the whole procedure, as well as tying the listener down to the one spot.

Localization in Depth

So far, we have discussed only the question of how we perceive the angle from which sound is received by the ears. In order completely to locate a source of

sound, we must also be able to tell how far away it is. The ear can do this, mostly because it has learned to recognise the differences in sound intensity that known sounds make when they are closer or farther away. Another thing that helps, when it is present, is reverberation, or echoing. As anyone who has listened to the effect of placing a single microphone nearer or farther from a speaker or musical instrument can appreciate, the proportion of reflected, or reverberant sound in the total received by the microphone increases rapidly, the farther this is from the source. Thus, the ears are able to judge distance by this means when reverberant sound is present, as it always is in greater or lesser degree when one is inside. Frequently, when in the open air, reflected sound is so slight that this aid to the

judging of distance is quite ineffective, and our judgement must be made solely on the basis of the loudness of the sound.

Stereophonic Sound

Some time has been spent on describing the mechanism of binaural hearing, in order that the reader may appreciate more readily just what stereophonic systems attempt to do. As the table shows, there is no normal listening experience that corresponds with a stereophonic system. Stereophonic reproduction, therefore, is no more than a complicated technical trick, designed to delude our hearing apparatus into believing that we are experiencing true binaural listening to the source of sound being reproduced. Many people in the past have believed that stereophonic systems are equal in all respects to binaural systems, but we will now show that this is not the case at all. The apparent similarity comes about only because the most often-used type of stereophonic system does use two microphones, two amplifying channels, and two reproducers, as does the true binaural system using headphones. Here, however, the similarity ends, because although the numbers of channels in the two cases is the same, the fact is that the ideal stereophonic system would use a very large number of microphones and loudspeakers, each pair with its own amplifying channel; two-channel stereophonic reproduction is thus the simplest possible form of what is a much more complex system, which is illustrated in Fig. 2.

The ideal system of stereo reproduction would place in front of the space occupied by the sound source a row comprising a very large number of very small microphones. In front of the listening

space, there is a corresponding number of small loudspeakers, each connected through its own amplifier to the corresponding microphones. The diagram illustrates the system quite clearly. It is fairly obvious that such a system would be impracticable, on economic grounds, especially if recording had to be involved, as it almost always must.

It has been found, though, that the "ideal" system is not necessary, and that reducing the number of complete channels to three, or even to two, still gives the required illusion. In the ideal system, the many loudspeakers act as point sources of sound, identical with that picked up by the microphones, and project into the listening space a composite pattern of sound identical in every respect with that created by the original source.

Fig. 3 illustrates the conditions obtaining when a three-channel stereo system is used, but it has been shown that with such a simplified system, conditions are so different from those of the ideal system that the brain uses an entirely different mechanism in recreating the sound. Instead of each ear receiving one pulse (for a single pulse from the sound source) it now receives three separate ones in rapid succession. The time differences are so short that the ears are unable to distinguish them as being separate. As a result, the hearing mechanism of the brain interprets them *as though they were a single sound pulse* coming from an apparent sound source, located somewhere in the space between the outer loudspeakers. The time differences are still short, but they are long compared with the maximum of 700 μ secs. which the ears are accustomed to in ordinary binaural hearing. Also, BOTH ears are hearing the output of the three speakers in the customary binaural fashion. It is clear from this that there is no natural situation which duplicates or even resembles the conditions presented to a listener by a stereophonic system using a very small number of channels, as two or three. We were thus correct in saying earlier in this article that the stereophonic systems used in practice create the illusion of binaural listening. Stereo sound is therefore just as much a "trick" as an optical illusion produced by half-silvered mirrors. This is not a criticism of it. There is no doubt that the disappearing trick, done with black drapes and half-silvered mirrors does work, because it produces the required illusion. If a stereophonic system is equally successful in "fooling" the hearing apparatus as the former is for the seeing mechanism, then it can be counted equally successful.

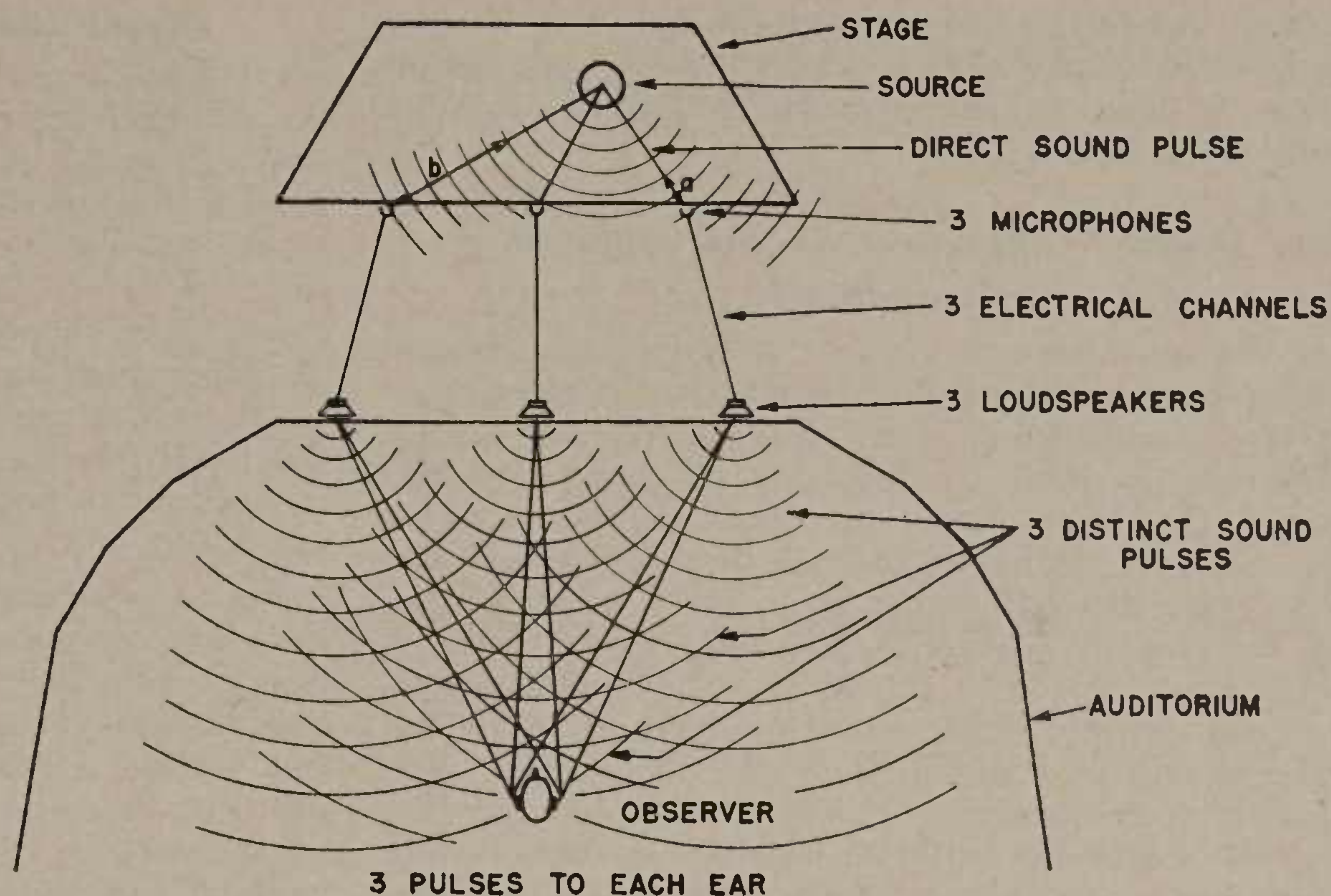


Fig. 3. Actual 3-channel stereophonic system. A practical stereophonic system gives a multiple reproduction of the original sound which the observer interprets as coming from a single source.

After all, simple single channel reproducing systems aim at no more than creating the illusion that we are listening to actual music. The only difference between sound reproduction, of any sort, and a magician's tricks is that in the former case, we all understand how the illusions are produced, and there is thus no mystery; in the latter case we seldom know by what mechanism the illusions are produced.

Producing Stereophonic Sound

How, then, does a simple two- or three-channel stereo system succeed in giving the ears the impression of being able to locate the source of sound, as in true binaural listening?

The most obvious effect which can help to do this is that the intensity of sound picked up by the two microphones, and thus reproduced by the two loudspeakers will be different. Obviously, if the sound issuing from one of the speakers is almost inaudible compared with what is coming from the other, the sound will appear all to come from the second. Equally obviously, if the intensities from the two speakers are equal, the sound will appear to come from half way between them. If the source of sound moves, the ratio of intensities reproduced by the speakers will change, and so will the apparent position of the source.

These considerations suggest that the stereo effect could be produced equally well by having a system like the last one in the table of Fig. 1. Here, a single microphone is used, but the speakers are fed by separate amplifiers, so that ONLY the intensity of sound coming from each can be varied. Such a system has actually been used, and does go part of the way

towards producing the desired illusion, but it does not have other attributes possessed by a proper stereophonic system, so that its results fall considerably short of the latter's.

Quality Differences in Stereophonic Reproduction

If the microphones used in a simple two-channel system have different directional characteristics for different frequencies, there will clearly be quality differences as well as intensity differences in the channels as the source of sound moves. Angular localization is definitely affected in this way. It has been found that the higher frequencies, at which the ears have higher directivity, contribute most to stereophonic effect. In other words, if the overall loudness from the speakers is the same, one tends to locate the apparent source at the speaker with the greatest output at high frequencies. On the other hand, low frequencies contribute little or nothing to stereophonic localization of the source. Thus it is possible to preserve the stereo effect by having only one central low-frequency speaker, while reproducing only frequencies above 300 c/sec. from the spaced speakers. This is most important in the production of low-cost stereophonic systems for use in the home. Among other things, it means that only one large, well-baffled speaker is needed.

Arrival-Time Differences

As with true binaural listening, arrival-time differences between the sound pulses received from the two speakers do assist the listener to localize the sound source. It has been proved that one tends to localize the sound towards the speaker which produces the sound first.

According to Snow, this effect is relatively independent of where in the system the time-differences are actually produced, thus making it possible to enhance or reduce it in the listening room, as, for example, by placing one speaker slightly nearer the audience than the other. It so happens that the time-difference effect aids the intensity effect.

Other Effects

So far, this article has concentrated on the main effects which enable stereophonic reproduction to be successfully applied. There are, however, many other things that come into the picture, about which we have not space here to write fully. One of the more important is the question of the listener's position in the room. It is fairly obvious that what has been written so far assumes that all listening positions will be equally good, but such is not the case. If the listener is not centrally placed with respect to the loudspeakers, the apparent source of sound shifts in the same direction as he does. The effect is not serious, however, and can be overcome by correctly spacing the speakers in relation to the listening room.

Application of Stereophonic Sound

Of most interest to readers of this article will be the practical angle. We have recently been treated to demonstrations of one practical stereophonic system, so that the question arises of whether stereo sound is likely to arrive in this country on a commercial basis, and if so, in what form. Naturally enough, the most useful application to musical reproduction, is the production and playing of stereophonic recordings. Until suitable methods of making such records were developed, stereo sound remained almost a scientific curiosity, but now, all those interested in recorded music can take an active interest in it.

The immediately obvious candidate for making stereo recordings is the now well-known twin-track tape. In principle, nothing is easier than to record the two channels of a stereo system side-by-side on the two tracks of standard magnetic recording tape. In practice, too, this method is not too difficult. It involves only a tape deck with two recording heads working simultaneously, one on each track, and thereafter using the same heads for two-channel playback. Indeed, many amateurs who have the requisite deck could modify it so as to make and play back their own stereophonic tapes. Several companies in America, and at least one in the United Kingdom are actually producing stereo tapes at the moment, so that if one can afford the playing equipment, stereophonic music can be regarded as here already. There are two methods of tape head mounting that have been used. One, which looks like becoming standardized (it is used in the Ampex equipment demonstrated recently by Mr W. G. Leatham) has the two heads mounted vertically one above the other. This involves the making of a special double head, since it is not possible to place conventional heads in this way, while getting the working faces close enough together.

The easier method, that could be used by anyone, is to use staggered heads. That is to say, one head is some distance from the other, thus making mounting easy, and allowing two conventional heads to be used. Unfortunately, unless a standard distance is used between the heads, it is not possible to play on one machine, a stereo tape made on another. However, this should not deter those who are experimentally inclined, and who may wish to try their hand at making and playing stereophonic tapes. Before long, though, it should be possible to obtain the special double heads that are needed for playing back stereo tapes made with co-incident heads. It will then be possible to fit these to many standard decks in use at present, turning them into stereo players.

Stereophonics on Discs

Although tape qualifies so easily for making and playing double-track recordings, the possibilities of the disc should not be discounted. This is because there are so many more people with disc-playing facilities than with tape playing machines, and because the pub-

(Concluded on page 51.)

BOOK REVIEWS

"Transistor Circuits", by Rufus P. Turner, publisher, Gernsback Library Inc., New York 11, N.Y. Price in America \$2.75.

This book is exactly what it says. In his introduction, the author states that the circuits featured have been culled from various sources. They are intended, he says, to be used as circuit "building blocks", with which to "design" more complex equipment, thus saving time in engineering design work. To some considerable extent, these claims are justified, but a word of warning is necessary. The author does give the essential characteristics of all the circuits used, such as input voltage or current, output voltage or current, power gain, power supply requirements, and so on. He also gives a qualitative description of how the circuits work. Professional engineers will find some of the devices described interesting, but will be able, and will no doubt prefer to do the detailed design work themselves. For example, the author gives no figures for such important things as stability factors, which the serious designer will want to know. Thus, for serious work, the apparent time saved by taking one of the recommended circuits and using it rather than starting a design from scratch may in many cases be illusory, since bench time will be involved in carrying out comprehensive tests of the circuit given, in order to gain more information than the book gives about it. However, for amateur experimenters, who in general are not in a position to carry out original design work themselves, the book will be found a most interesting and useful one. Almost every conceivable application for transistors is covered in some way by the book, although its circuit techniques are certainly not quite as up to date as one might be entitled to expect from the recency of its publication. For example, there is no mention at all of single-ended push-pull audio amplifier circuit, nor of any of the many arrangements for using loudspeakers without output transformers.

Considerable use is made of the special characteristics of n-p-n and p-n-p transistors, especially in the section dealing with D.C. coupled amplifier arrangements. All circuits are complete with component values and transistor type numbers, and it will undoubtedly be possible for anyone with only an elementary knowledge of transistors and their application to build a large number of working devices from the book, provided he has available the transistors and other components mentioned in the text. For New Zealand consumption, however, a difficulty is that few American transistor types are available. In spite of this, it will not be difficult for more knowledgeable builders of equipment to "translate" the circuits in terms of transistors that are freely available here. Altogether, a most interesting volume that this reviewer can well recommend with the reservations already noted.

"Transistor Circuit Engineering", edited by Richard F. Shea, with eight co-authors. Publisher, John Wiley & Sons Inc., New York. Price in U.S.A. \$12.00.

This volume represents the exactly opposite approach to the previous one reviewed on this page. It is, as its name suggests, an engineering text proper, which sets out with the aid of the necessary mathematics to develop design formulae from first principles. The material is thus of universal application, and should be read by anyone seriously interested in transistor circuits. The mathematics are not elementary, however, and makes free use of matrix algebra. The subject matter covers the whole range of transistor applications, and is extremely up to date, as would be expected from the authors, all of whom are members of the engineering staff of the General Electric Company of America. There is an excellent bibliography to each chapter, and each chapter is followed by a selection of numerical problems.

From this brief description, one might be excused for believing that the book will be of little interest to anyone whose mathematical attainments does not match those of the authors, but such is not the case at all. The authors are engineers, not mathematicians, which means that they do not employ maths for its own sake. On the contrary, the book has a very strong practical bias. After developing a set of design formulae, these results are illustrated in a practical way by worked out examples, using throughout the numerical characteristics of a very few hypothetical transistors, whose characteristics are given early in the book.

These transistors assume the guise of old and trusted friends before one has followed them through many chapters. Moreover, the developed formulae, and the performance graphs with which they are liberally illustrated, are easily translated mentally into terms of actual transistors whose characteristics may be known to the reader.

In spite of the liberal use of mathematics, the book is eminently readable, much of its contents being of a descriptive nature. If you are the type who is looking for ready-made circuits, complete with values, then Rufus P. Turner's book is the one for you, but if you want to be able to design circuits from scratch, in the almost certain knowledge that they will then require a minimum of exploratory bench-work, "Transistor Circuit Engineering" is your meat.

It should be pointed out that this book takes a good deal of concentrated reading; it is well worth it, though, and should find a place on every electronics engineer's shelves.

A RECORDER-GRAM CIRCUIT FOR AMATEUR CONSTRUCTORS

Judging by the success of our recent tape-recording articles and that of the several excellent radio-gramophone circuits we have published within the last twelve months or so, it seems likely that many of our readers would appreciate constructional details of a complete recorder-gram arrangement, such as has become quite popular on the commercial market lately. The article below is the first part of one describing a complete outfit which incorporates several refinements not found in the commercial article.

Introduction

For quite some time now, we have been surprised that present-day amateur constructors of radio equipment seem to prefer tackling things that no so long ago would have been deemed far too ambitious for anyone but an experienced professional to attempt. For example, by far the most popular constructional articles that this journal has presented during the last two or three years have been high-quality radio-gramophone combinations, high-quality audio systems, and, of course, tape recorders. Interest in small receivers, or in any but amplifiers capable of the best possible quality, seems to have dwindled to the vanishing point, if we except transistor-operated gear, which seems to have caught the fancy not only of professional engineers but also of amateur transmitters and builders.

So it is that we come to present a short series of articles describing what is probably, in some ways at least, the most ambitious piece of equipment our laboratory has designed and built for the edification of constructors. It is realized, of course, that many of those who build equipment from the descriptions in these pages are, in fact, professional radio men, building for sale to the public, or to the order of someone who has read the article, and for one reason or another, does not feel like taking on the job himself.

This does not mean that the outfit to be described is not recommended for amateur constructors. It most definitely is, for, although the recorder-gram circuit to be described is certainly an ambitious one, with a most excellent specification, there will be found nothing about it that builders of "R. and E." circuits have not managed successfully before.

It should be pointed out in this connection that all the circuits used in the recorder-gram have been used before in these pages; this is a considerable advantage, because they have been very well tried and tested—much more so than any entirely new circuitry could be—and so can be expected to be as trouble-free as they can be made. We would venture to predict that our most assiduous readers (if we may flatter ourselves that we have any such) will find the greatest interest in the recorder-gram centred in the features that have been incorporated to make it as "usable" a device as possible. That is to say, a great deal of thought has been put into making the finished article as easy to operate as possible by even the most non-technically

minded user. In our opinion, this is very important; it is not always appreciated, even by manufacturers, while amateur builders, though they may concoct a system which performs excellently in all respects, often finish up with a maze of control knobs, switches, and plugs and sockets that almost needs a steam ticket to drive! Such a system is all very well when the originator is present to work it, but can be wellnigh useless for anyone else—his wife and family, for example. We sometimes suspect that things are made like this with malice aforethought!

Seriously, though, when a single integrated piece of equipment includes radio tuner (with selectivity control), record-playing equipment, with provision for all kinds of record, and, to top it all off, a tape recorder, it is quite a difficult matter so to arrange things that the abovementioned maze of knobs and other assorted controls does not materialize. If we add to this the requirement that it must not be necessary to unplug one part of the equipment in order to make another part function, it can readily be realized that the designer's life is not always an easy one. The problem under discussion occurs more frequently in gear of good quality than in commercial equipment, because the latter simply refuses to provide many of the facilities that the quality enthusiast demands. But to get on with the story.

Features That Have Been Incorporated

Before going on to describe how it has all been done, it would perhaps be best to outline the features that have been built into the recorder-gram circuit.

(1) Radio Section

- (a) Broadcast band only.
- (b) Superhet circuit, with R.F. stage and band-expanding, two-position I.F. transformers.
- (c) High-quality, low-distortion detector circuit.

(2) Audio Section (power amplifier only)

- (a) Push-pull triode connected EL84 output tubes, 5 watts output at speaker terminals.
- (b) High-quality output transformer, and moderate degree of negative feedback over the whole amplifier, giving very low distortion figures and excellent transient response.

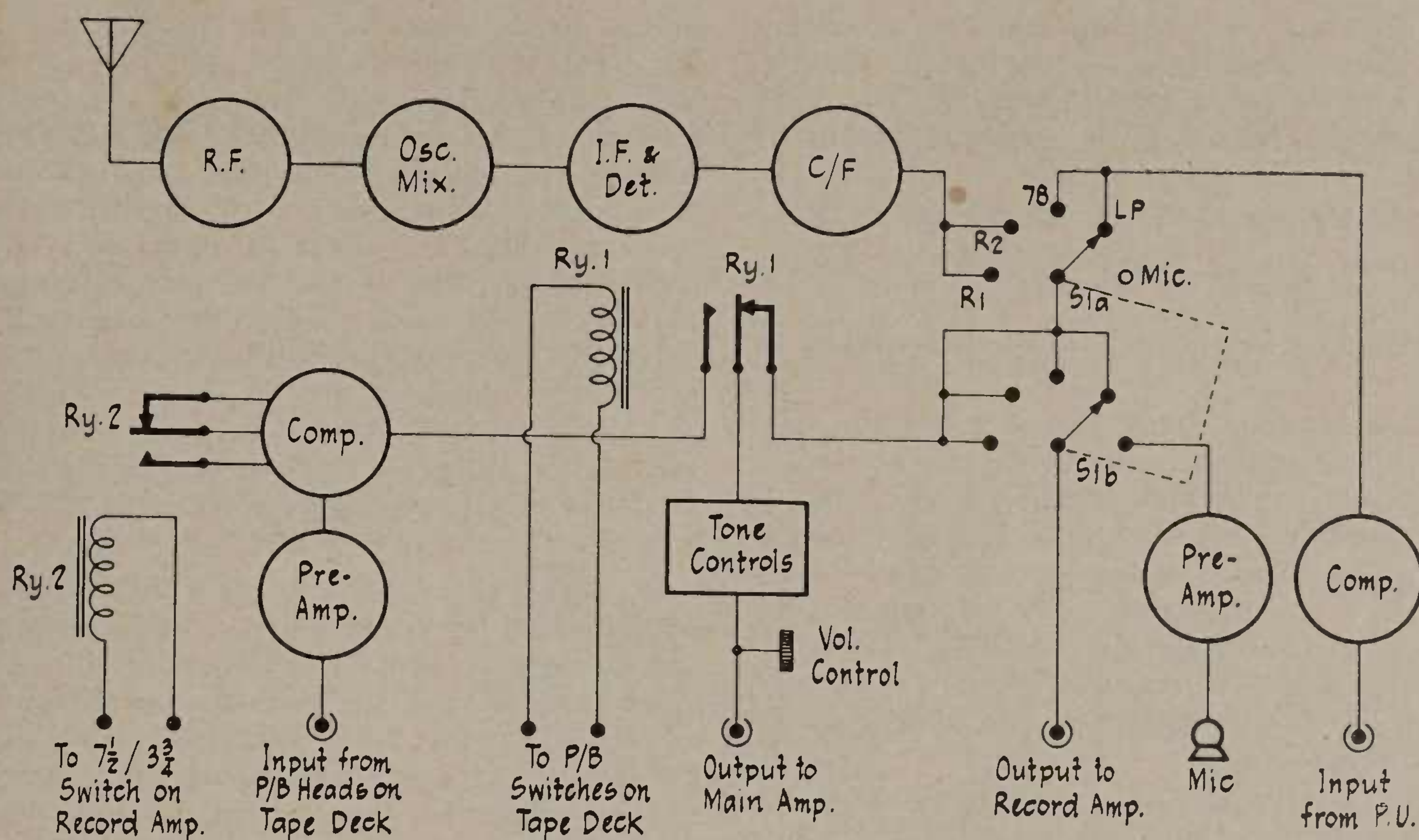


FIG. 1.

(c) Input voltage for full output, 0.21 volts R.M.S.

(3) Tape Recording and Playback Section

(a) Bias and erase oscillator-amplifier arrangement, recording amplifier, and playback pre-amplifier are all as have been used in our previous tape circuitry.

(b) Bias, erase, and recording circuit is built separately, on a small chassis, which mounts close beside the tape deck.

(c) Playback pre-amplifier, using two EF86s, is on the same chassis as the radio tuner and other pre-amplifier circuits.

(d) Electrical interlocking is used to prevent either recording or playing back with the wrong frequency compensation for the playing speed.

(e) Collaro tape deck is used, at either $7\frac{1}{2}$ or $3\frac{3}{4}$ in./sec.; 15 in./sec. speed is not used. Correct compensation is used for each speed, so that on each the best possible frequency response is obtained.

(f) Automatic arrangements are made for feeding to the recording circuit whatever is being heard from the loudspeaker. It is thus unnecessary specially to switch or plug the output of either the radio tuner or the record player to the recording circuit; the only exception to this is recording from microphone. To do this, one has only to move the main selector switch in the control panel to the position marked "Mic." When this is done, the input to the loudspeaker is automatically cut off, so as to prevent acoustic feedback.

(g) No special action has to be taken to play a tape. Pushing either of the playback buttons on the tape deck automatically disconnects from the main amplifier what was previously being heard, and at the same time connects it to the output of the tape playback pre-amplifier.

(h) An independent input control for the recording amplifier, together with a pick-off for the recording amplifier *before* the volume control, ensures that the latter, and the recording level control, are independent. Adjusting the one has no effect on the other.

(i) The tone controls (independent bass and treble) operate on any signal that is coming from the speaker, but have no effect on the signals fed to the tape recording amplifier. In this way, records are made with the standard frequency response, irrespective of how the response controls are set for listening.

How it is Done

The above list is quite imposing, so that it may place some strain on the imagination to see how all these things can be accomplished without undue complication. In fact, by the use of a single relay, most of the complication is caused to disappear, as the block diagram of Fig. 1 will readily show.

First of all, it should be pointed out that the equipment has been built in four units. This has been done advisedly, in order to make stowage easier. It would have been quite possible to put the whole equipment on two chassis—one for the recording amplifier, which has to be as close to the tape deck as possible, and another carrying everything else. Had this course been followed, the second chassis would have been too large for comfort, and it would thus be difficult to house in a cabinet, or to build into an existing cupboard, for example. By splitting up the gear into four chassis, several advantages accrue. In the first place, two of them can be placed anywhere, out of the way, and not necessarily even in a cabinet, since they contain no controls, and need to be got at only for valve replacement or servicing. The recording amplifier chassis mounts beside the tape deck, and carries only the recording gain control and the switch for changing the recording

and playback circuits over to suit the two recording speeds. All other controls are on the fourth chassis, which is only the size of a conventional radio set, and so is easy to mount, whatever the physical lay-out of the equipment.

The four chassis are therefore as follows:

- (1) The audio power amplifier, with its power supply.
- (2) The recording amplifier, with the bias and erase circuits.
- (3) The tuner chassis. This also includes the tape playback pre-amplifier, the tone control circuit, the pick-up pre-amplifier stage, and a microphone pre-amplifier. On this chassis are all the controls, so that it is necessary to shift one's attention from this unit only to operate the tape deck or to adjust the recording level control. This gives the maximum possible operating convenience, as the tuner is thus the control centre for the whole outfit.
- (4) A small chassis holding a separate power supply, feeding everything but the main audio amplifier, which has its own.

All this is made clear on the block diagram. Everything centres round the main function switch, S_1 , which has five positions. The first two, labelled R_1 and R_2 , connect the output of the radio tuner to the input of the tone control circuit, via the normally closed contacts of the relay Ry_1 . The two radio positions are provided because the tuner has two-point selectivity control, giving normal selectivity in the first position, and broad bandwidth in the second, for high-quality local-station listening.

The next two positions are the Gram positions, one for 78 r.p.m. records, and the other for L/P. Here, the output of the pick-up pre-amplifier is fed to the tone controls, and thence to the main amplifier. It will be noted that the main switch has two banks, S_{1a} and S_{1b} . The first of these performs the switching just described, while the second acts as follows. Whichever programme source is selected by the main switch and fed via the relay and tone control circuit to the main amplifier, is also fed out to the input of the recording amplifier, BEFORE it has passed through the tone control circuit, and before it has passed through the volume control. This simple arrangement gives the features listed in (h) and (i) above; in particular, it makes the effects of the main volume control and the recording level control independent of each other.

The fifth position on the main switch is labelled, for want of a better term, "Mic." This position comes into action only when it is desired to use the tape recorder to record from the microphone. The circuit shows that in this position, S_{1a} removes all inputs from the main amplifier, while S_{1b} simply feeds the output of the microphone pre-amplifier through to the recording amplifier.

So far, the function of the relay and its contacts has not appeared in the story. It will be noted that Ry_1 has the leads to its coil passing out from the tuner

chassis to the tape deck. For all the functions so far described, it is un-energized, and the normally closed contact takes the audio output of the selected source through to the main amplifier. When the relay closes, however, the output of the tape playback pre-amplifier is connected to the tone-control circuit, and thus to the main amplifier. The function of the relay is to do this automatically, when one of the playback buttons of the tape deck is pressed. Thus, the relay coil, which is fed from the H.T. line through a series resistor, has its circuit completed only when one of the playback buttons is pressed. At the same time as the tape pre-amplifier is connected to the amplifier input in this way, whatever was previously connected to the amplifier is automatically disconnected.

We think everyone will agree that all this is simple enough, and yet it does away, at the cost of a relay and some very simple wiring, with the necessity for performing at least two operations every time one wants to play a tape. It also does away with the necessity for several extra positions on the main selector switch, which would then become very complicated. For example, if the relay circuit were not used, operation of the tape recorder would have to be something like this. The main switch would have to include separate positions for "Record" and "Playback." Also, there would probably have to be a separate switch, to organize which input was being fed to the recording amplifier, as well as the main one which determines what comes out of the speaker. All told, the thing would contain more control knobs to find room for and add to the complexity of operation, and at the same time the circuitry would contain more complex switch wiring.

We hope, therefore, that we have convinced anyone who does not like the idea of scattering relays through his equipment that, in this instance, it is very well worth while.

The second relay is associated with the tape playback circuit, and its sole function is to change over the response compensation to suit the playing speed that is in operation. It is necessary because the switch for doing this is most conveniently located at the recording amplifier, where the circuit changes are more complex. Thus, on this switch, an extra bank has been provided which energizes Ry_2 when it is put into the "3 $\frac{3}{4}$ " position. A simple change-over contact is all that is required, because the only circuit change necessary is to alter the value of one condenser in the playback pre-amplifier.

The Main Amplifier Circuit

The circuit of the main amplifier that has been designed for this outfit is shown in Fig. 2. It is quite similar to several amplifiers that have featured in this journal, but is not the worse for that! The main difference between it and the last one or two we have designed is that this one is not so sensitive. For a system such as this, where the main power amplifier is separate from the pre-amplifier circuits associated with it, it is good practice not to make the amplifier too sensitive. The purpose of this is to allow a reasonably sized signal

A TRANSISTORIZED QSO-GETTER FOR 40-METRE QRP CW OPERATION

By E. M. WASHBURN, W2RG*

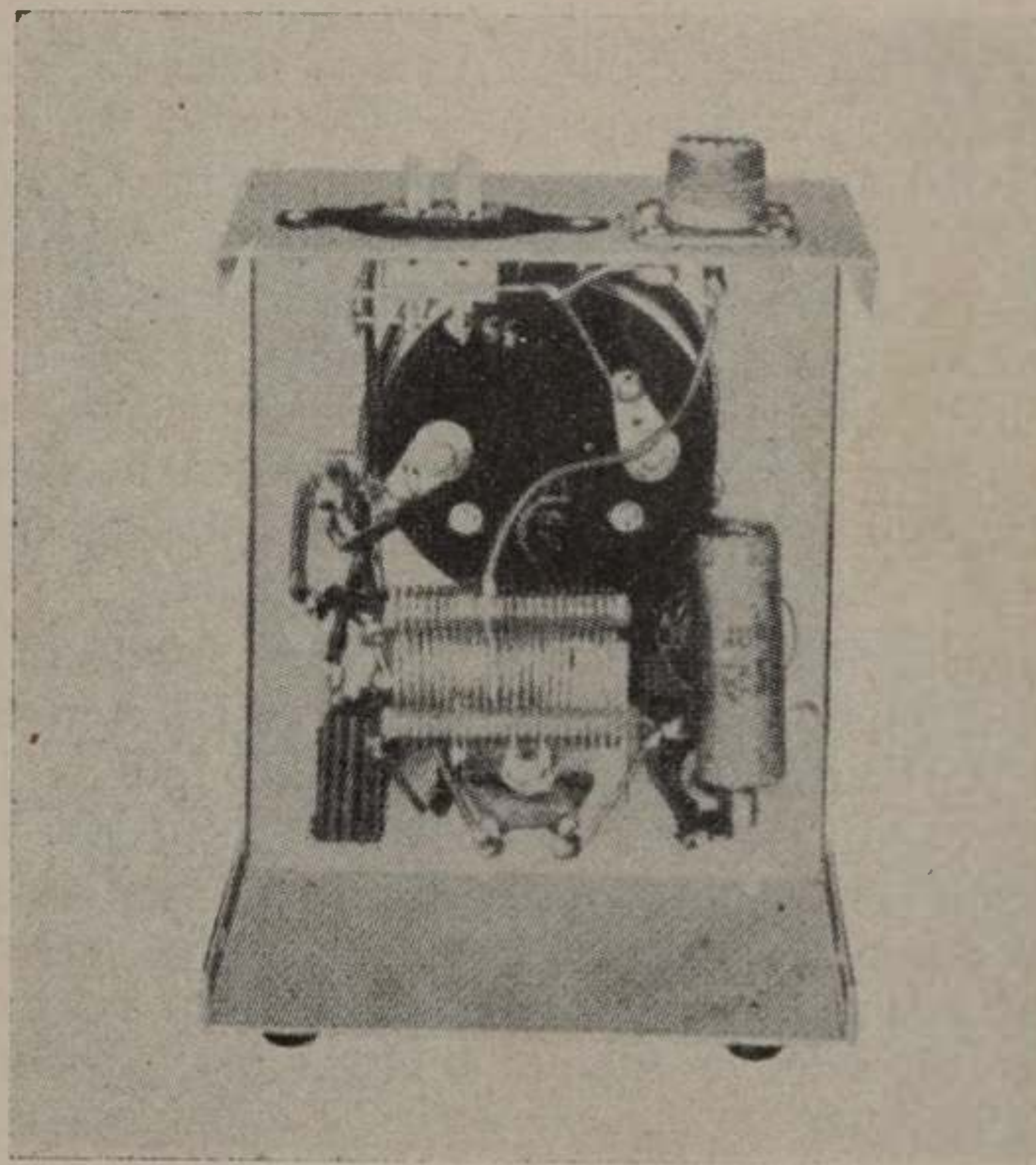
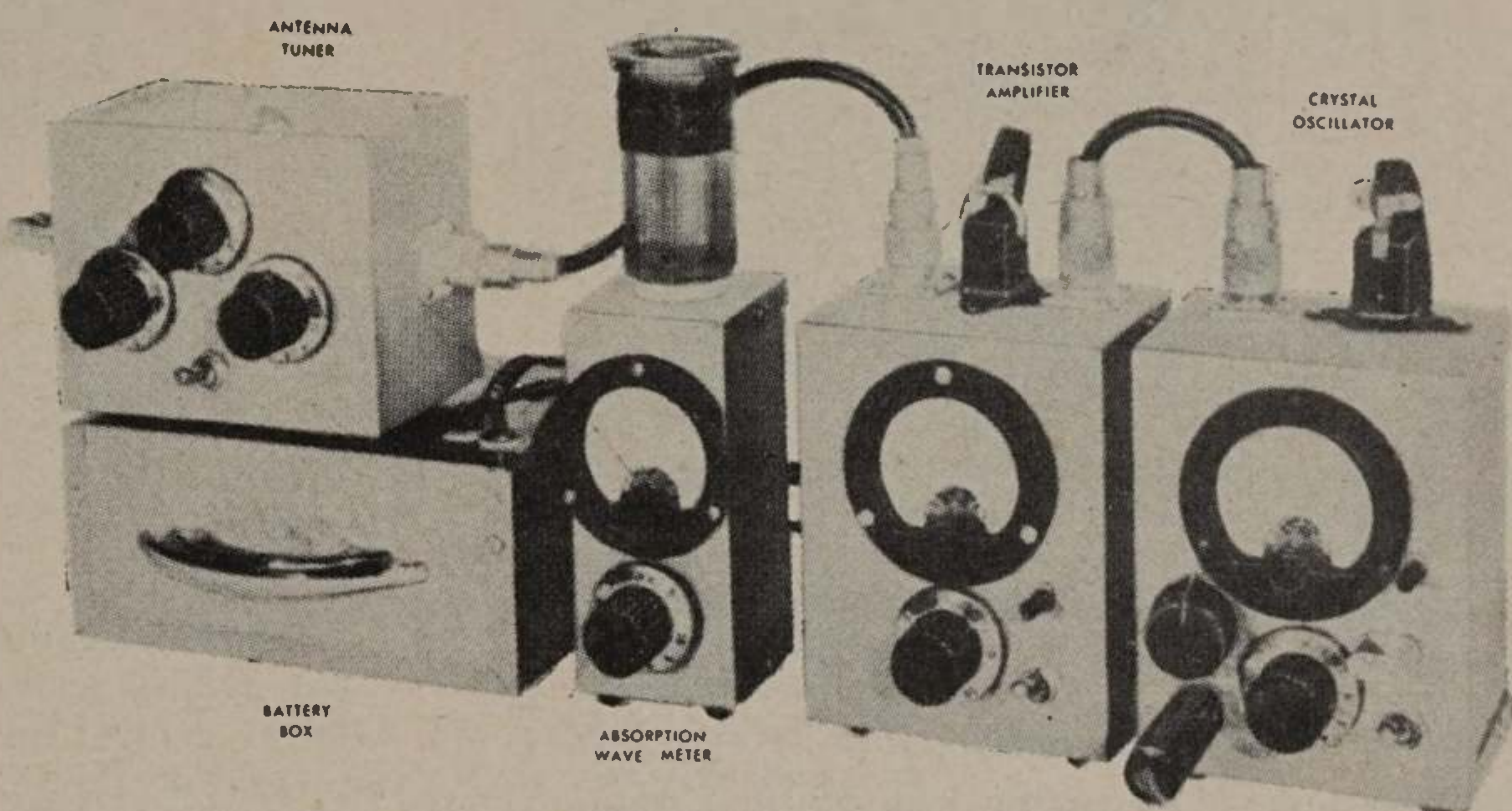
(The following article is reprinted exactly as written in "RCA Ham-Tips." Suitable transistors are now available in New Zealand, so there is no reason why amateurs in this country should not duplicate Mr Washburn's equipment and his results.—ED.)

The transistorized QRP transmitter illustrated and described in this article is essentially a 40-meter cw rig, using one RCA-2N140 transistor in the crystal oscillator and another in the amplifier. The transmitter is adequately powered by two 6-volt, heavy-duty dry batteries, connected in series, which are provided with a switch to permit tuning up at 6 volts. When the transmitter is operating at full load, the crystal oscillator operates at 12 volts with a collector current of 15 milliamperes, while the amplifier operates at 12 volts, 18 milliamperes. Admittedly, these inputs are *in excess* of the manufacturer's ratings and some transistors may not operate satisfactorily under these overload conditions. An RCA-VS069 1.5-volt dry cell is used in the oscillator-emitter circuit as shown in the schematic diagram.

During the Spring and Fall of 1956, the author worked 18 states, Ontario, Quebec, Puerto Rico, Windward Islands, and Transvaal, S. Afr.—all on 40 meters—with an antenna consisting of a single, 106-foot wire. The wire used with the author's transmitter is strung 28 feet across the basement rafters, then leaves the confines of the shack and slopes upwards for a distance of 42 feet to a flat top which is 36 feet long and 28 feet above the ground. The antenna can be voltage-fed from the amplifier or it can be fed from the antenna tuner.

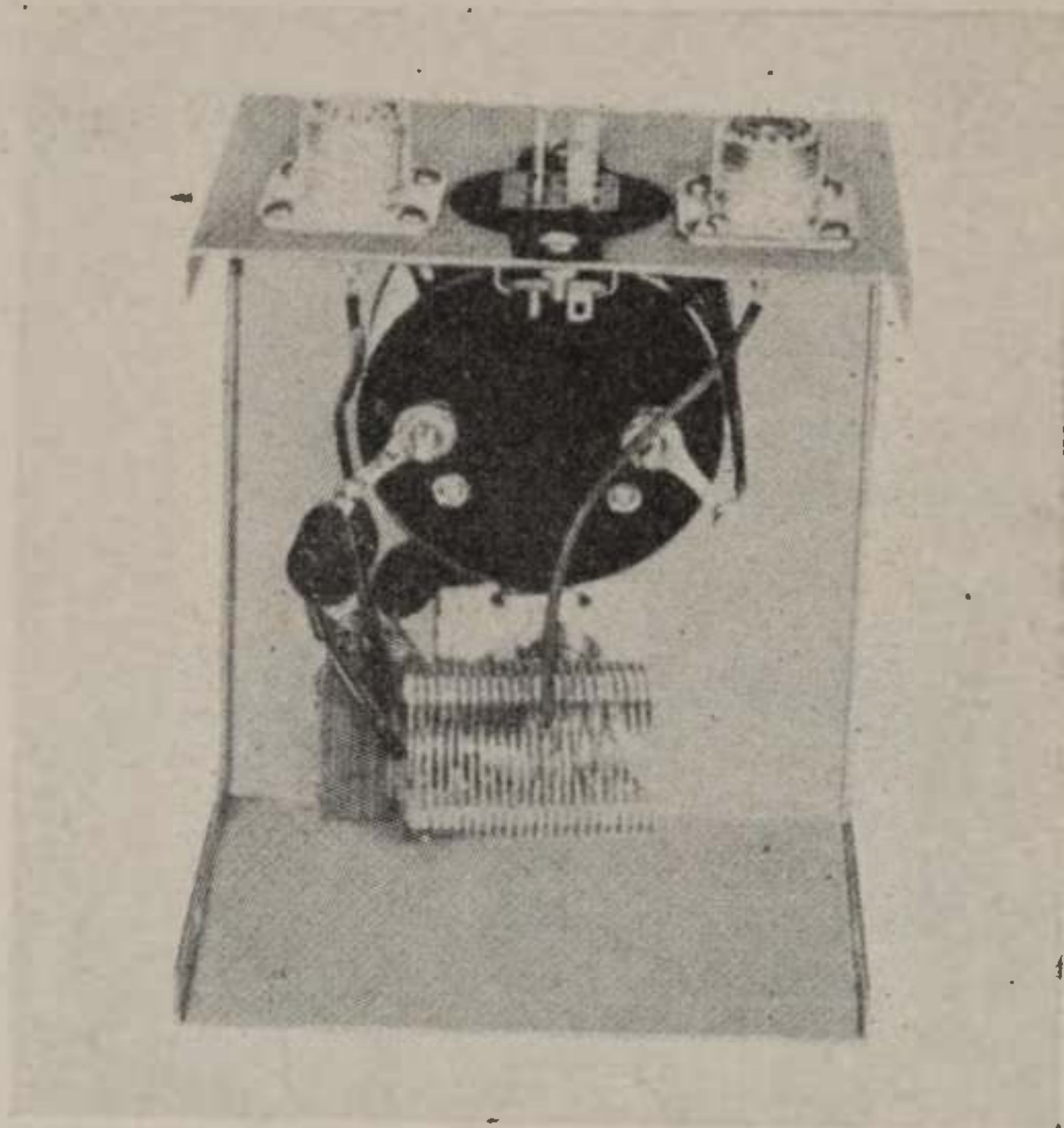
Over a long period of operations, the signal reports received by the author have varied from RST-339 to 589, depending upon band conditions, distance, and the type of receiver used by the receiving station. The QSO with Transvaal, S. Afr. (ZS6TR) appears to be a world record for a 40-meter low-power transistor transmitter and the contact was made without any form of pre-arrangement and without any previous communications using higher-power rig. At 216 milliwatts and covering a distance of 8,000 miles his performance is comparable to 37,000 miles per watt at a frequency of 7002 Kc.

Several contacts have been made on the 80-meter band, but the most gratifying and successful results



1. Complete transistor rig. Maximum input to the final amplifier: 216 Mw.
2. Rear view of crystal oscillator. Best dx on 40 meters was ZS6TR, 8,000 miles, Transvaal, S. Afr., without pre-arranged contact.

have been accomplished in the 40-meter band. To the present, no attempt has been made to put the QRP transmitter on the 20-meter or the higher frequency bands; however, this band could be worked by using



3. Rear view of transistor amplifier.

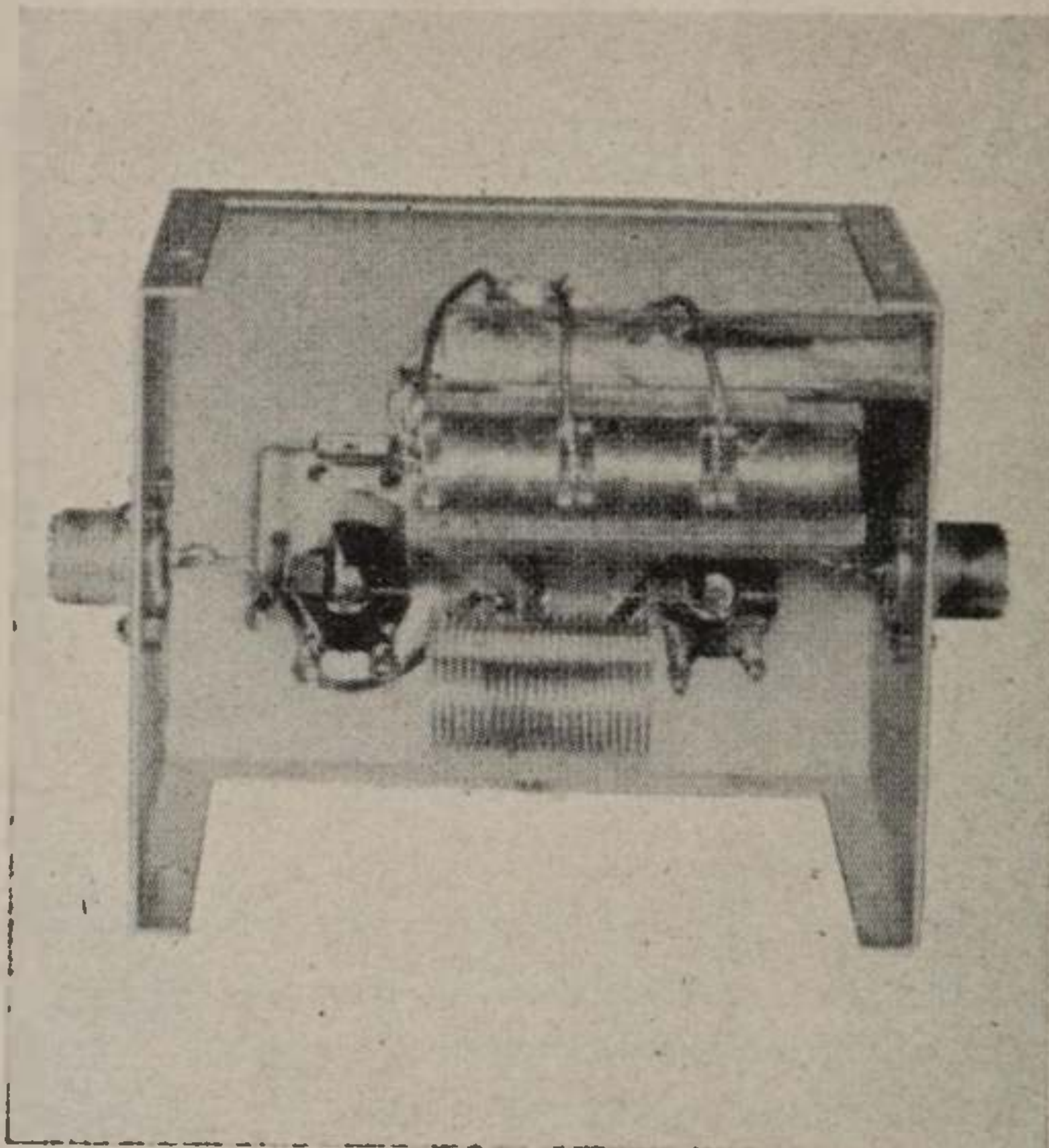
the amplifier as a doubler stage and substituting an RCA-2N247 transistor for the RCA-2N140.

Construction

The complete transistor transmitter station comprises five units as shown in the photograph. The wave meter would normally be placed several feet away with its pickup coil about 2 inches from the antenna wire. Since this absorption wave meter is entirely conventional and the battery box is merely a housing for the two 6-volt dry batteries and the 1.5-volt dry cell, the circuit description will be limited to the crystal oscillator unit, amplifier and antenna tuner. Each of these three units is housed in a minibox which measures 5 inches by 4 inches by 3 inches. Interior construction details are shown in the photographs of each.

Although VFO circuits have been tried, the only successful operation has been with crystal control, and in this particular design the crystal unit is in the emitter circuit. The key is by-passed by a low-voltage 2 μ f capacitor to improve keying characteristics, particularly when a "bug" is used. The most critical adjustment is the location of the output tap on the base inductor to achieve stable performance, free from "birdies."

Whether or not an amplifier is used, the output tap on the tuned circuit inductor should be just far enough from the ground end for a stable signal, free from multi-vibrator type "birdies" when the key is first closed. In the unit described, the tap is almost at midpoint, 10½ turns from the ground end with a total of 23 turns in the coil. The optimum location for this tap must be obtained by "cut and try" method, keeping the collector voltage low and backing down on the emitter potentiometer to avoid exceeding 15 ma collector current.

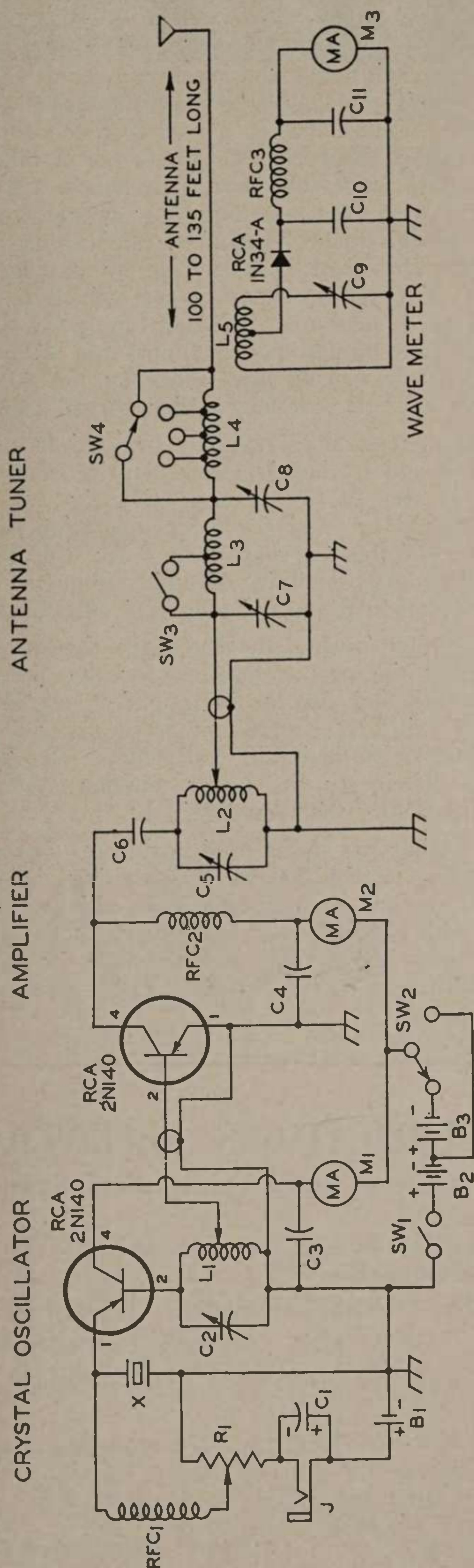


4. Interior view of antenna tuner.

The transistorized crystal oscillator is shown with the 2N140 transistor just above the crystal unit. The lower central knob adjusts the variable tuning capacitor, while the left-hand knob is used to set the "bias" potentiometer at optimum for clean keying at full output. The switch at the lower right is the main battery on-off-switch, while the jack at the lower left is for the key. On top of the unit, the coax connector is for the rf output and the four-prong male connector is for the 12-volt and 1.5-volt supplies from the battery box. The inside components of the oscillator are shown in the photograph.

In the amplifier circuit, the only critical adjustment is the location of the tap on the collector tank coil. The optimum position must be found by trial, but should be near the midpoint or slightly towards the ground end. Because one set of batteries is used as the 12-volt supply for both the oscillator and amplifier, the on-off switch may be omitted since the common ground is made through the coax cable.

The use of an antenna tuner was found helpful, although not essential. The absorption wave meter, however, is considered an absolute necessity, since it gives a sensitive indication of the radiated energy. During tuning operations, this meter pickup coil may be located close enough to the antenna wire (about 6 feet from the tuner or transmitter) to give a meter reading at about half-scale, assuming that full scale is about 200 μ a. Then it should be removed completely or decoupled until the needle movement is just visible. Although the tuner circuit contains more components than absolutely required, it does permit precision tuning for optimum radiated power at minimum collector current, and in lower power work of this particular type every individual milliwatt must be utilized to produce maximum power for maximum contacts.



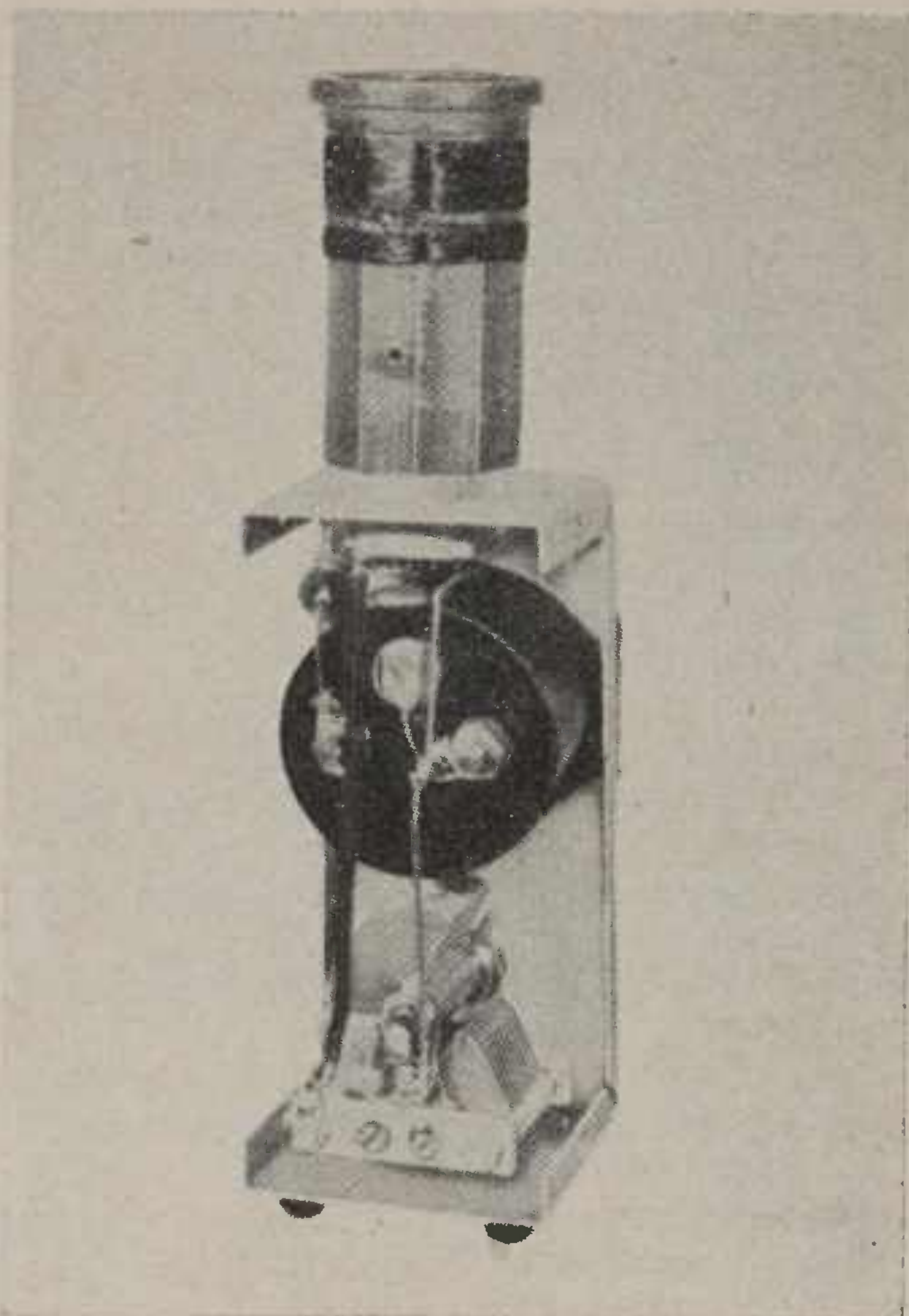
PARTS LIST

- B₁—Battery, 1.5-volt (RCA-VS069, or equivalent)
- B₂—Battery, 6-volt (RCA-VS009, or equivalent)
- B₃—Battery, 6-volt (RCA-VS009, or equivalent)
- C₁—2 μ f, electrolytic
- C₂—0-100 μ f, variable
- C₃—0.01 μ f
- C₄—0.01 μ f
- C₅—0-100 μ f, variable
- C₆—0.001 μ f
- C₇—0-100 μ f, variable
- C₈—0-100 μ f, variable
- C₉—0-50 μ f, variable
- C₁₀—0.001 μ f
- C₁₁—0.001 μ f
- L₁—23 turns B & W Miniductor #3015, tapped near center
- L₂—23 turns B & W Miniductor #3015, tapped near center
- L₃—23 turns B & W Miniductor #3015, tapped near center
- L₄—2 $\frac{3}{4}$ " length B & W Miniductor #3016, 3 equal taps
- L₅—Any size 40-meter pickup coil center-tapped, which tunes through band, with C₉
- M₁—0-20 dc milliammeter
- M₂—0-20 dc milliammeter
- M₃—0-100 microammeter
- R₁—100,000 ohms
- RFC₁—RF choke, 1 mh
- RFC₂—RF choke, 1 mh
- RFC₃—RF choke, 1 mh
- SW₁—SPST switch
- SW₂—SPDT switch
- SW₃—SPST switch
- SW₄—Switch, 4-position
- X—Crystal, 3.5 or 7.0 Mc
- RCA-2N140 Transistor (oscillator)
- RCA-2N140 Transistor (amplifier)
- RCA-1N34-A Semiconductor Diode (wave meter)

As in conventional transmitter tuning, increasing the load will also increase the collector (plate) current, but instead of tuning the tank circuit for a dip in

collector current, the more positive indication of proper loading is maximum wave meter current at minimum collector current. Maximum radiation normally will not be at maximum current in the collector circuit. Adjustment of the emitter potentiometer in the oscillator is quite critical for optimum setting.

In all tuning operations it is advisable to listen to the signal in the station receiver. As the voltage on the oscillator emitter is gradually increased and oscillation starts, the signal will sound very strong, even before there is any indication of collector current in the amplifier. As the emitter potentiometer is advanced slowly, the oscillator collector current will increase and the keyed signal will become clean, with a slight ringing which is characteristic of crystal oscillator keying. Unfortunately, if there is any indication of radiated power under this setting of the potentiometer, it will be very small, and the emitter voltage should be further increased. At about 10 ma collector current, there should be a definite amplifier collector current and a wave meter indication of radiated power, and all tuning controls must be adjusted carefully until



5. Construction details of absorption wave meter used to indicate maximum radiation from antenna.

peak radiation is reached. During this final tuning, "birdies" are very liable to be heard in the receiver all over the dial, and tuning must be readjusted until the only signal heard as at the crystal frequency. If tuning alone is not effective in eliminating these spurious oscillations with a "cold" transistor, the emitter voltage in the oscillator must be reduced or the tap on its base coil moved further from the ground end.

When the keyed signal is clean, and free from "birdies", with collector current between 12 and 15 ma in the oscillator and 15 to 18 ma in the amplifier, and with a good indication of radiation in the absorption wave meter, that meter should be removed or coupled very loosely. The rig is then all set for normal use.

In at least one respect, operation will not be normal, and that is in establishing contacts. The only successful method experienced by the writer has been in answering general calls and rarely by calling CQ, CQ-TR, CQ-QRP, or any other form inviting a QSO. Experience teaches that it is well to listen for a few seconds before answering a CQ, to see if others are answering the same call. If so, it is almost a waste of time to answer, even assuming your crystal frequency is close enough to be hopeful of establishing contact. The writer has had best success by having a fair selection of crystals, choosing one which is in the least occupied portion of the band, tuning for optimum radiation at minimum power input, and waiting for someone to call CQ on that frequency. On 40 meters you don't have to wait long under normal conditions.

On 80 meters, a 2N139 may be used in place of the 2N140 and is slightly lower in price. Cut-off frequency of the 2N139 is approximately 5 Mc. The 2N140 should be used for 7 Mc. operation, with its higher cut-off frequency at about 8 Mc. Future QRP rigs hold many possibilities of higher-frequency operation, voice modulation, and increased efficiency.

Your author wishes to emphasize the importance of selecting the proper location for the tap on the oscillator coil and also on the amplifier coil. Both are extremely critical for optimum performance. The antenna tuner described will load almost any kind of wire, but obviously the better antenna system employed, the better the results will be.

Your author has never used any form of beam and all contacts, nearly 200 at this writing, have been without previous arrangement and without previous contact with higher power equipment. In the author's opinion, such "piggy-back" contacts void the attraction of the adventure in transistorized QRP amateur communications.

PUBLICATIONS RECEIVED

From C. & A. Odlin Ltd., Mullard Radio Valve Manual.

From E.D.A.C. Ltd., "Philips Miniwatt Transistors & Germanium Diodes."

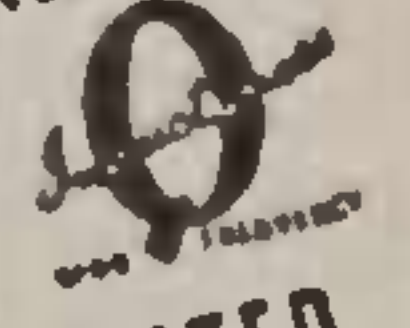
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From Collier & Beale Ltd., "Redifon Flight Simulators."

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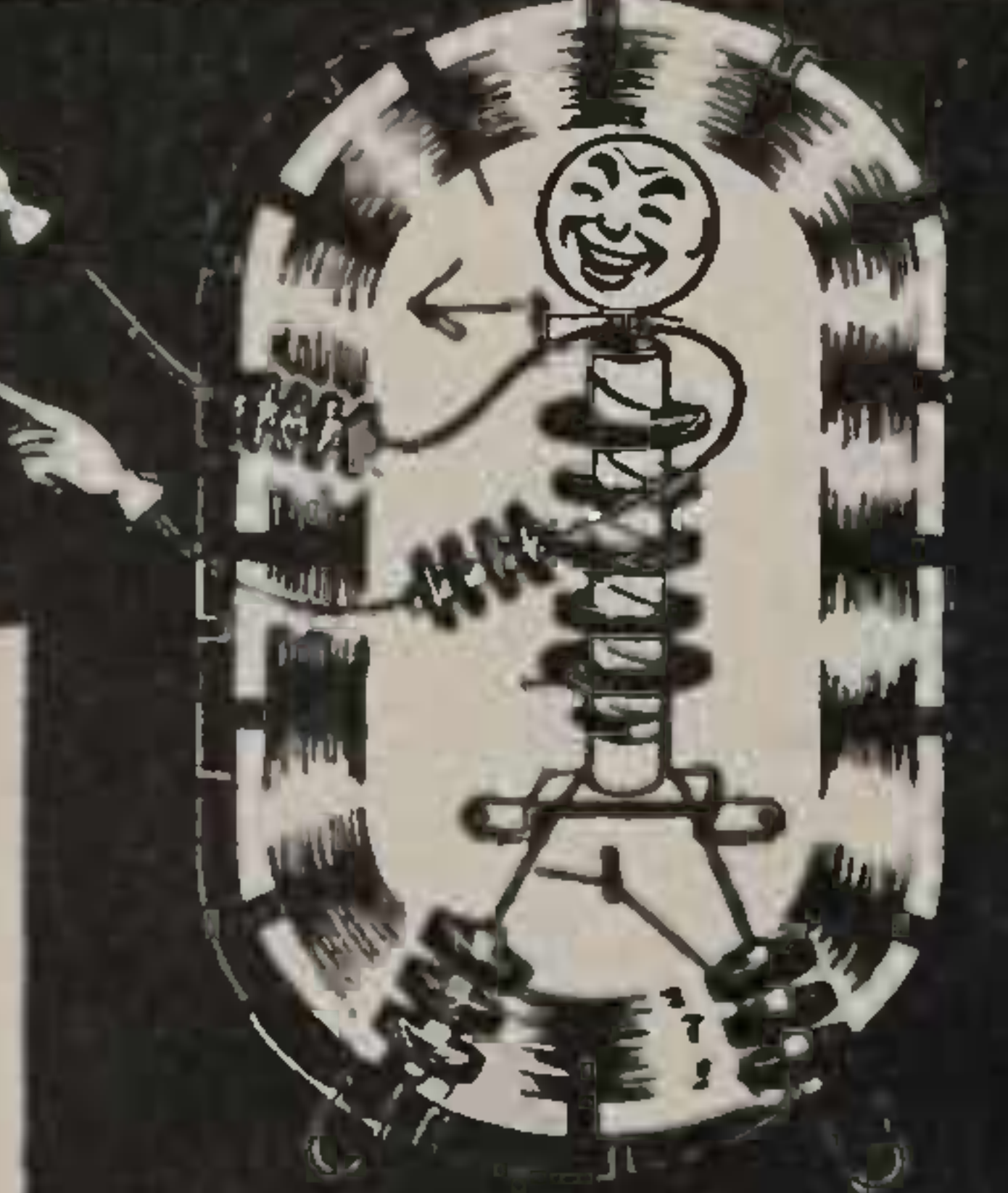
From B.G.E. Ltd., "A 250 mw Audio Amplifier using Transistors."

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GANGS, BUILT-UP UNITS, ETC.**

ELECTRICAL AND TRADE SECTION

ELECTRICITY IS SAFE—BUT SOME PEOPLE ARE CARELESS . . . YOU SHOULD KNOW WHAT TO DO

(Reprinted from "Live Lines", official organ of the Electrical Supply Authorities' Association of New Zealand.)

How safe is electricity? Like most other utilities it is as safe as the degree of care practised by the user. A box of matches is perfectly safe in the hands of a pipe-smoker, but in the hands of a child it could cause disaster. Similarly electricity is safe if ordinary sensible care is taken in its use.

However, there is little time to remonstrate with the careless person after an accident occurs. What is needed there and then are the knowledge of what to do and the presence of mind to apply that knowledge. That is why we publish this article on the Holger-Nielsen method of artificial respiration in cases of choking, drowning, or electric shock.

For choking or drowning get the patient into the described position and begin artificial respiration immediately.

In cases of electric shock, however, you may have to clear the patient from contact with electrically charged metal. When such is the case, the following is the wisest procedure:

Switch off or disconnect power is possible, or free the patient from contact by means of insulating material such as dry wood, rubber, dry rope, a glass bottle, and the like. Never use your bare hands or any metallic material. Above 230 v. there is always a risk attached to the use of make-shift insulated material.

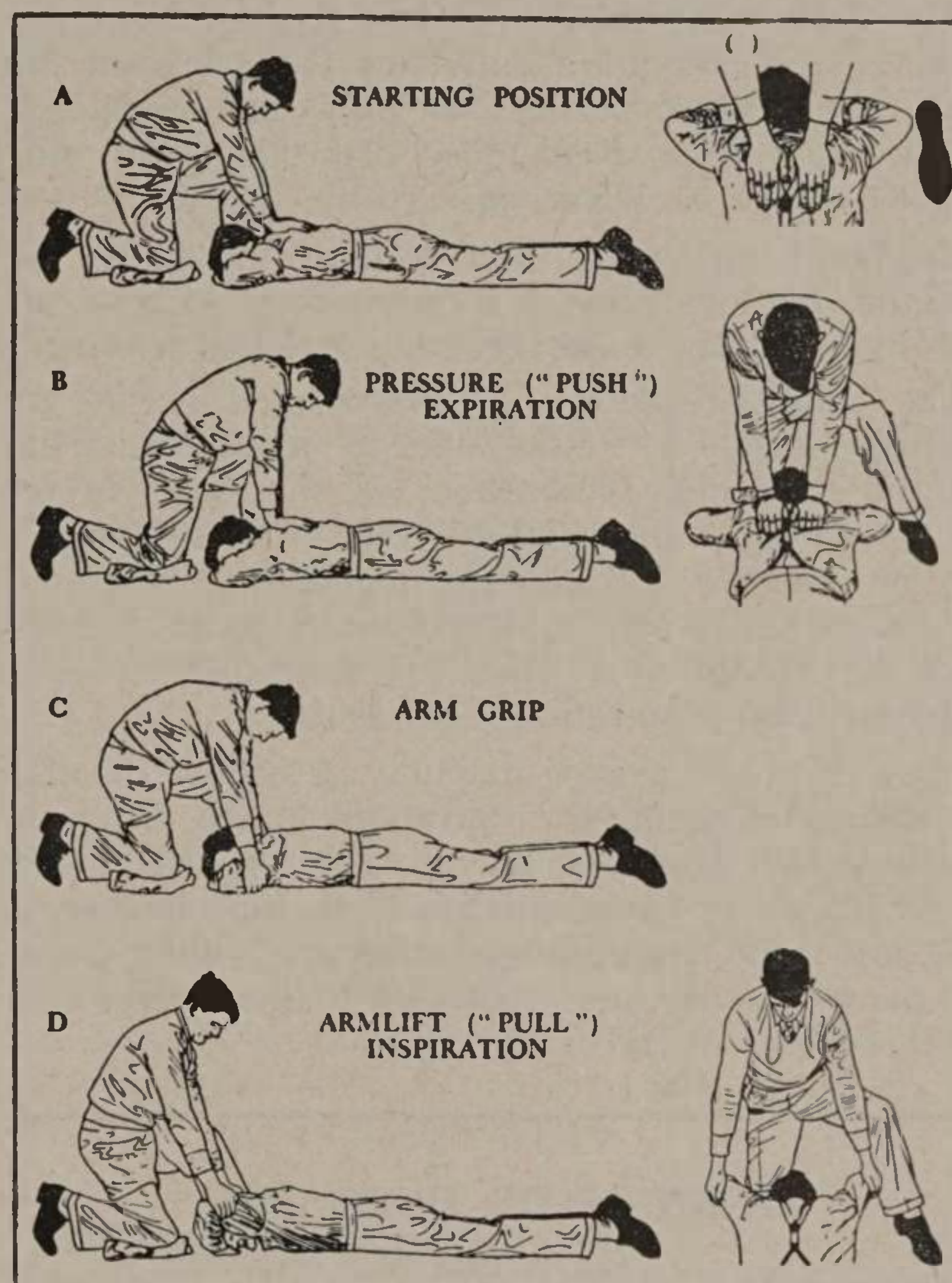
Always safeguard your own personal safety.

You have an unusual and important task to perform. Do not panic.

After freeing the patient, begin the treatment immediately. If he is lying on his back, roll him over in the following manner: Bring both of his arms straight over his head, then, in a kneeling position, place one of your hands over his shoulder, the other hand under the arm-pit and quickly pull him over.

Place the patient as shown in position A in the diagram with the head down, and fingers of the left hand locked over the right wrist, legs straight and heels together.

Then take up your position, as shown in A, legs muscles controlled, give three medium slaps between the shoulder blades, turn the head to one side and inspect the mouth for dislodged dentures and feel that the tongue is lying forward in a normal position. This latter point is very important for if the tongue has receded there is very little chance of the patient's



recovery. You must get the tongue forward and keep it there.

With the arms straight, place the hands as shown and, according to circumstances, exert a downward pressure as follows: Adults, 33 to 44 pounds; 6 second cycles; 10 times a minute. Small women and children—using finger tips only, 22 to 26 pounds; upwards to 12 times a minute. Infants—use thumbs only, 2 to 4 pounds; upwards to 15 times a minute. Endeavour not to exceed these pressures.

A guide to the timing of the 10-cycles-a-minute operation is to count: "One and two. Change. Four and five. Change." Look at the diagrams and read them as follows:

A. Starting position.

B. Pressure on. Pressure off. "One and two." "Change."

C. Arm lift. "Four."

D. Backward pull. "Five." This operation should not be overdone. "Change."

Endeavour to keep a uniform rhythm with a definitely controlled pressure.

This treatment should be kept up for a period of from two to five hours without interruption.

When breathing is either partially, or fully restored, then use diagrams A and B only and endeavour to time your movements with the rate of breathing of your patient.

The injuries themselves will determine the method used. If the patient is suffering from broken arms, then use diagram A and B only and exclude the arm-lift C and D. Remember that you alone will be the sole judge of what you are able to do.

Electrical burns are best left in the hands of a qualified person. Cover if necessary with a clean cloth or towel but do not use any make-shift remedies.

The condition known as after-shock needs to be carefully watched. Some aids to identification are: Vomiting, peculiar coloration of the face, hysteria, and a seemingly unquenchable thirst. These symptoms may be dangerous. Keep the patient reclined on his side, keep him warm and endeavour to calm him as much as possible. At the first sign of a relapse, begin artificial respiration once again.

Lack of space would preclude all of the details of the science of artificial respiration, but if this article has interested you, you may carry it a little further. There are many books published on this subject, and there are many organisations who are willing to help. Use the means at your disposal, for in so doing YOU MAY SAVE A LIFE.

TRANSISTOR PORTABLE

(From page 50.)

temperature of 65° to 70° F, the normal total battery current should be 8.75 m.a. to 9.5 m.a. Under these conditions, the output stage should operate satisfactorily throughout the life of the battery and under normal variations in temperature.

A milliammeter with a scale of not less than 100 m.a. should be used. Care should be exercised in re-setting the resistor to avoid sustained excessive total battery currents.

To Remove Chassis

To remove chassis from case, first draw off tone and volume knobs, unscrew dial knob and draw off knob. Draw off dial scale, fully mesh variable condenser.

Remove 3 chassis support screws and withdraw chassis by swinging outward on lower edge and slewing slightly to clear battery switch.

Some Dos

Begin treatment without delay.

Take effective means to keep the tongue forward. Keep rhythm and pressures as constant as you can.

SEND FOR A DOCTOR as soon as possible and be sure to mention that it is a case of electric shock.

Always state that it is an electric shock case for an ambulance call.

Use any bystanders to assist in providing warmth for the patient. Get them to massage the insides of the legs, in an upwards direction from the calves to the crutch. Procure hot-water bottles, not too hot, warm blankets, and the like. Select one to watch your movements so that he can take over if necessary.

Some Don'ts

Don't panic or you will quickly tire yourself.

Don't waste time in making the patient comfortable. Get busy.

Do not discontinue the treatment simply because somebody suggests that the patient is dead.

Do not give stimulants until the patient is able to swallow, and then only sweetened tea, not a stiff brandy.

Do not allow the patient to sit up but encourage him to recline on his side and take things easy.

In any treatment for after-shock do not apply local heating to soles of feet, or extremities. Encourage the blood circulation by covering the patient with warm blankets.

To refit chassis, reverse the sequence of the above, taking particular care that:

- (a) Variable condenser is full meshed.
 - (b) Approximately $\frac{1}{8}$ in. clearance exists between dial disc and fixed cursor.
 - (c) Tone knob is fitted with shaft turned fully clock-wise and with "off" knob adjacent to fixed "off" indicator.
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CHANGE OF ADDRESS

When you change your address, be sure to notify the

Subscription Department, "Radio and Electrical Review", P.O. Box 6361, Wellington New Zealand,

and do this at least four weeks in advance. To avoid disappointment through not receiving your copy of "Radio and Electrical Review", should it go to the wrong address through your failure to notify us of a change, we earnestly ask for your co-operation in this important matter.

EICOnomise - Buy EICO INSTRUMENT KITSETS

TV ROUND THE GLOBE

Public Interest in Colour TV Growing— says RCA

Public interest in colour television is higher than ever and several major manufacturers are planning to get into colour on a large scale this fall, John L. Burns, president of RCA, said in Los Angeles on June 12. Mr Burns asserted that he feels colour television is going "pretty well for a new product."

"With each passing week," he continued, "we see indications—and by indications I mean steadily mounting sales—that the public is interested in colour television and wants it. This interest in colour television was pointed up sharply during a test conducted last month in Milwaukee which was serving as a proving ground for a nation-wide colour TV promotion campaign. During Milwaukee's five-week 'Carnival of Colour,' TV sales increased by almost 800 per cent.—from an average of 12 sets a week before the test to 106 sets a week. We feel that the Milwaukee test demonstrated conclusively that public interest in colour is higher than ever before, and that the public will buy colour TV when the sets are properly exposed, demonstrated, and promoted."

TV Seen Raising Educational Levels

A new era in education when a top-flight teacher will lecture to students all over the country simultaneously by closed-circuit television and earn a salary comparable to the highest paid business man or entertainer was envisioned on June 16 by John L. Burns, president of RCA, in a commencement address at Northeastern University.

Mr Burns, who was awarded an honorary degree of Doctor of Business Administration by his Alma Mater, said the widespread use of classroom TV would help combat the twin shortages of faculties and facilities, and provide the highest quality instruction by making it possible "to draw upon the greatest teachers in America."

State-sponsored Educational TV System

A state-sponsored educational closed-circuit television system will be installed this summer by RCA for the Georgia Department of Education, it was announced on June 11 by Dr M. D. Collins, State School Superintendent, and E. C. Tracy, manager, RCA broadcast and TV equipment department.

The RCA educational TV system will be installed in The Conley Hills Elementary School, Fulton County, and will go into classroom operation in September. It will serve primarily as a "laboratory" installation for Georgia educators who are studying the practicability of state-wide teaching-by-television as authorized by the State Board of Education. Mrs Mary Grubbs is the TV co-ordinator of the State Department of Education.

The TV system at Conley Hills will be a multi-channel installation, embracing four RCA TV camera chains linked by closed-circuit with twenty-six RCA Victor TV receivers installed in classrooms throughout the school. Film and live educational TV programmes will be originated from a centralized TV studio now under construction within the school.

Electronics to Advance in Three Fields

The electronics industry is now on the threshold of big advances in the fields of industrial and commercial electronics, military electronics, and colour television, John L. Burns, president of RCA, said on May 16 at Chicago.

Speaking at a luncheon of business and civic leaders, Mr Burns stated RCA will help to pioneer and develop advances in these areas. He continued:

"Industrial and commercial electronics. In this area we expect an increasing application of automation and telecommunications in industry, office work, agriculture, commerce, and the home. Automation depends largely on electronic controls, thus offering opportunity for substantial growth. Telecommunications will be extended to many types of business and personal needs.

"Military electronics: We expect an even greater stress to develop within the Armed Forces on electronic weapons, controls, and communications. RCA is engaged in numerous projects in this area, and is making some of the latest applications in electronics in the guided missile weapons systems, electronic controls for jet aircraft, fire control systems, and airborne communications and air traffic control.

"Colour television: One of the most significant advances in home entertainment within the last ten years has been the development of colour television which RCA has pioneered and continues to promote enthusiastically. We believe that colour television is ready for major advances. RCA's efforts in this field are backed up by all the creativity of NBC's fine producers and talent."

During Mr Burns's three-day Chicago visit, he toured RCA and NBC facilities located in the city.

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.

NEW PRODUCTS:

LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars, contact Advertising Manager, R. & E., Box 6361, Wellington

New Pye Mantel Radio with Three Speakers

"3-D Sound" is the telling phrase which will catch the public imagination over this new Pye radio. It seems a particularly apt expression to apply to this set since it is, as far as we know, the first mantel radio to be introduced in New Zealand with three loudspeakers.

Apart from bringing an appreciable improvement in performance, this innovation provides a valuable talking point for retail salesmen. The "more enthusiastic" might be led to use the words "high fidelity" in this connection, and the 203 does, in fact, come as close to Hi Fi as a radio can. It is a 7-valve, 5-band set, provided with one 8 in. and two 6 in. x 4 in. speakers by which bass and treble frequencies are reproduced in perfection to suit the most critical connoisseur.

It would be logical (and correct) to assume that with this wealth of loudspeakers, some provision would be made for record playing. Pye Model 203 is equipped with switched pick-up sockets and gives quite outstanding record reproduction (at least equal to a good radio-gram) in association with an adequate record-player-crystal, ceramic, or high impedance.

A feature of the Pye 203 is the emphasis placed on station selection and tuning. The Pye Magic Eye "Twin-Vision Tuner" is not merely an attractive sales feature: it materially assists the listener to tune correctly by visual means.

Finding stations operating on shortwave frequencies presents little difficulties on the 203. By bandspreading two of the four shortwave bands, Pye facilitate station selection and cuts to the irreducible minimum interference from stations operating on similar frequencies. Bandspreading would seem essential on sets used at all often on the short wavelengths.

Yet another attractive design feature of this new Pye model—inspired possibly by motion-study research in other fields—is the use of concentric controls. Instead of four knobs, we find two only. Each dual concentric knob operates two entirely separate sets of controls, but takes up no more space than an ordinary conventional control. The improvement this makes possible in the appearance of the fascia of the set is further enhanced by the use of "Pyelite" controls. When the set is switched on, the two controls glow with a pleasantly subdued light, adding greatly to the selling power of the radio when under demonstration to a prospective purchaser.

The question of furniture appeal looms an even larger consideration in both the manufacture and, of course, the selling of modern radio. Technical excellence, when supported by first-class design in the latest

modern styling and materials, makes a far greater impression on today's style-conscious market.

The Pye 203 is housed in a magnificent cabinet of dark mahogany veneers with contrasting trim in light woods and gilt strip. Its dimensions are 21 in. x 8½ in. x 14 in. and weighs 25 lb. A rich golden grille cloth and a long 5-band coloured perspex scale add delightfully to its visual appeal. The "Twin-Vision Tuner" and the "Pyelite" controls look handsome on the set and prove even more attractive when the radio is on and they light up.

These features, *plus* the "3-D Sound" of the set's three speakers should do much to ensure big sales for this new Pye mantel radio.

The 203 will be retailing at £59 2s. 6d.

Sole New Zealand distributors: Pye Limited, P.O. Box 2839, Auckland, and at 148 Tory Street, Wellington, and 16-18 Victoria Street, Christchurch.

* * *

"Pacemaker" Transistor Portable



Illustrated above is the new "Pacemaker" transistor portable distributed by H. W. Clarke Ltd., and made by Collier & Beale Ltd. It is very attractively styled, and has numerous features that will commend it to dealers and public alike. It uses eight of the most modern transistors, and is unique, in this country at least, in having a high-gain R.F. amplifier stage. This accounts for its remarkably high sensitivity, while its large speaker and 250 milliwatt Class B output stage makes it eminently suitable for use in even a large room. For power supply, it uses a 6-volt lantern battery, readily available anywhere, and it has the remarkably low idling current of approximately 10ma. A set of this nature will obviously be an economical one to run, even judged on the operating cost of a small A.C. set, so that it can be used without cost disadvantage both inside and out. Its performance is so good that it can be used successfully even inside a modern car.

TRADE WINDS

New Sales Manager for Russell Import

Russell Import Co. Ltd., announce the appointment of Mr P. C. Taylor as sales manager, in succession to Mr D. Lavin, who has left the company to take up another position.

As a result of internal re-organization, Mr Taylor will be maintaining much more frequent personal contact with the firm's clients than has hitherto been possible, and he thus looks forward to making the acquaintance of his company's trade friends as soon as possible.

Russell Import's new offices and show-room at Bond Street, Wellington, are now completed, and visitors are assured of a warm welcome should they venture to brave the winds of the capital.

* * *

R. & E. had a visit the other day from Johnnie Brown (well known to Philips dealers throughout the country) who brought along Mr R. Cooper, who has been appointed service manager for New Zealand for Philips. Among other things, they discussed with the Editor the recently-instituted series of training lectures being provided for Philips servicemen in Wellington. The course is to include a substantial section on the principles of television.

Early next year, Philips intend to show the way to other manufacturers in the matter of television training, by laying on special courses in Wellington, specially for Philips dealers, and their service staff, who will travel thither from quite far afield.

Considerable interest is being taken in the proposed courses, and Philips are to be congratulated on showing such initiative. We are sure it will pay off handsomely later on!

OPERATION "CLOSE SHAVE"—A UNIQUE PHILIPS PROMOTION

Unusual promotional ideas were adopted by Philips Electrical Industries of N.Z. Ltd. to introduce their full range of 1957-58 Philishave Speedshavers.

Taking the form of dealer shows at various Aerodromes throughout New Zealand Philishave promotion programmes began with a 20-minute fashion parade featuring the coming season's swimsuits and



Product Promotion Manager, John Davey explains the new Philishave point of purchase material shown by Miss Faye Horwan. The Robot "Mr Philishave" completes the trio.

sunwear. Here opportunity was taken to introduce the Philishave "PRINCESS" shaver, specially developed to solve feminine grooming problems. At the conclusion of the parade Product Promotion Manager John Davey introduced the full Philishave range for 1957-58.

Practical demonstrations on stage were followed by the presentation of an impressive assortment of point of purchase material and details were given of the press and radio campaign which is backing the dealer in his sales effort.

Full details were also given of the new 14-day free trial scheme for Philishave which Philips are introducing in New Zealand, following the scheme's phenomenal success in other countries. Figures from overseas show that 87% of Philishaves sent out on free trial are sold. The scheme, which involves no risk as far as the dealer is concerned, has already been put into operation by a large number of retailers.

At each Aerodrome Show—appropriately called "Operation Close Shave"—the unique electronic robot



Parachutist Denny Main tells the audience about the Philishave "Town & Country" which he was shortly to use in the air.

"Mr Philishave" was introduced. This "walking" and "talking" electronic device has caused quite a stir wherever it has appeared.

Mr Philishave, at present on tour in the South Island with Philips mobile demonstration caravan P.E.P. No. 11, arrived in New Zealand from Australia several months ago. As can be seen from the accompanying photograph he takes the form of a Philishave Diplomat. Remote control enables "Mr Philishave" to move about and, at sales promotion functions, to speak to people on the advantages of using Philishave.

Highlight of the Aerodrome Shows was the staging of a unique parachute jump by the well-known parachutist, Denny Main from Hamilton. The jump was performed, weather conditions permitting, from a height of about 4,000 feet. Denny Main made it a delayed jump, usually falling 2,000 feet before opening the 'chute—a thrilling spectacle at any time—but he gave it more impact on these occasions by giving a running commentary on his drop which was relayed through a P.A. system on the ground.

After opening his 'chute Denny really did something unusual—he shaved himself with the battery model Philishave, the "Town & Country", and told the crowd on the ground how it felt to be enjoying a shave while making a parachute descent. An inspection of Denny's face when he reached the ground revealed the excellence of the shave.

Since the introduction of the five Philishave models and the 14-day free trial scheme Philips have launched a trade-in scheme whereby a person may receive 2 guineas off the price of a Diplomat triple header on production of an old electric shaver—any make, any condition.

N.Z.E.I. Wellington Branch TV Project

Progress is still being made on this project, albeit slowly. The latest piece of assistance to be forthcoming from the Wellington radio trade is the building of the wide-band cross-dipole structure, which has been designed by Mr W. D. Foster, who is in charge of the project, and which is being built under the aegis of Mr D. King, of TV Radio Ltd., Vivian Street, Wellington. This is a considerable step forward, because the aerial structure is quite a piece of construction, using several pounds worth of copper sheet and pipe, and containing quite a deal of work. The Wellington branch of the Institute is very grateful for this assistance, as well as for that which has so freely been provided by other firms.

* * *

Transmitter-Receivers for the Antarctic

R. & E. spent a very interesting hour the other day inspecting six transportable battery-operated transmitter-receivers which have just been built by Messrs. Collier and Beale Ltd. for Sir Edmund Hillary's Antarctic sledge parties. This is an excellent example of what the New Zealand radio industry is capable of. The conditions under which the equipment must work are extremely stringent, and Collier & Beale, and Mr J. Hird, who was responsible for the design work are to be congratulated on a remarkably fine job of work. We hope soon to publish an illustrated account of these most interesting sets, showing how some very unusual problems were overcome by the designers.

* * *

Versatile Designers

Other projects of Collier & Beale's with which Jim Hird was actively associated are the very advanced transistor portable, featured in this issue, and the television transmitting equipment which this firm built several years ago for giving public demonstrations. Needless to say, Martin Kimble, who is now a director of C. & B., has also had more than a passing interest in these projects. As long as New Zealand firms can command the services of technical men of the calibre of these two, there need be little fear that our industry will fall behind the march of events in matters of engineering.

* * *

L. D. Kerr Appointed President of Wellington Radio Retailers

At a recent meeting of the Wellington Radio & Electrical Traders' Association, the well-known Wellington retailer, Mr L. Denham Kerr, was elected to the position of president of the association, to fill the place vacated by Mr M. O'Sullivan, who is about to go overseas for his firm, National Carbon Co. Ltd.

This journal wishes Mr Kerr every success in his onerous position, which is more important this year than usual, in view of the impending re-organization of the traders' organizations throughout the country.

NEW ZEALAND RADIO-TV AND ELECTRICAL TRADERS' ASSN. (Inc.)

ANNUAL CONFERENCE AT WAIRAKEI

On September 7 and 8, at the Hotel Wairakei, the Association held its annual conference for 1957. It was the second to be held under the new constitution, adopted at the 1956 conference, which for business purposes divides the Association into separate Wholesale and Retail sections, and it proved beyond doubt that this is not only desirable but an eminently workable one, of great practical value.

Opening

The President (Mr W. Murphy), opening the conference, extended a cordial welcome to all those who had made a point of attending, and invited everyone to take part in the discussions. He extended a special welcome to Mr R. Waddell, of the Seddon Memorial Technical College, and to representatives of the *New Zealand Electrical and Radio Trader* and *Radio and Electrical Review*.

Apologies were received from the chairman of the wholesale section, Mr C. R. Peoples, and from Mr Bruce Barwick, President of the New Zealand Radio and Electrical Traders' Federation. After routine business had been settled, the conference adjourned to enable the wholesale and retail sections to conduct their separate meetings.

Wholesale Section

Profit Margins

After much discussion of this matter, which is of great importance to both retail and wholesale members of the trade, the Wholesale Section resolved to put the following views to the conference on its resumption:

"Wholesalers are viewing with considerable alarm the continued pressing on the part of retailers for increases in profit margins on radio and electrical goods. The Wholesale Group considers that retailers should be aware of the following facts before any further requests for increased margins are made:

"(1) Wholesalers point out that, contrary to general thinking, servicing costs will not increase in the future. The development of transistors and associated components will demand less in the way of after-sales service.

"(2) The only way larger margins could be effected in future without increasing retail prices would be for distributors to give part of the margin to the retailer, and we know that retailers will appreciate that manufacturers' and distributors' costs are increasing month by month. Development costs on such items as transistors, TV, and other electronic devices are a very costly item. Raw materials continue to rise, and we have no control over such increases.

"(3) It goes without saying that manufacturers and distributors are doing all in their power to at-

tain greater efficiency, and, indeed, some have brought in outside consultants to help towards this end. Newer machines and systems are in evidence in all plants at the present time. Such costs as are mentioned above, passed on to the consumer, would inevitably mean higher retail prices and consequent decrease in production, which in turn, of course, means a higher cost per article.

"(4) It is deplored that with the increases in margins that have already been given to retailers, some have seen fit to pass on some of this profit to the consumer by means of 'give aways'—free records, etc.

"(5) The Wholesale Section would point out that if retail prices rise to any great extent because of larger margins, the Government would certainly lose no time in de-licensing the industry, and retailers would then be at the mercy of overseas suppliers, who would probably not give them the items they wanted, but would very definitely consider this country a fair target for the dumping of obsolete and inferior goods. Retailers will know how difficult servicing problems become under such circumstances. Cost of guarantees would also tend to rise as far as the retailer was concerned.

"(6) The Wholesale Group would also point out that any retrograde steps, such as de-licensing, would result in smaller numbers of technicians being available for the retailer to use in a servicing capacity. It is considered, therefore, that the following recommendation is opportune, and most important to the industry generally:

The Wholesale Group recommends that if retail members of this Association are considering asking for further increases in profit margins, facts and figures as to reasons for such requests be tabled at the earliest opportunity."

REGISTRATION OF TECHNICIANS

The Wholesale Group was concerned at the fact that steps were not being taken in many cases to see that persons who could become registered under the regulations as they stand at present did, in fact do so. It was felt that a good deal of this was due to ignorance of the details of the legislation, and that many dealers would appreciate help from those who, through necessity, had

become thoroughly conversant with the regulations and how they were operated. After discussion, the following resolutions were passed:

- (1) *That a circular be prepared explaining ways of facilitating registration under the present regulations.*
- (2) *That all members of this Association advise the Seddon Memorial Technical College of the successful completion of technical training courses by their personnel, at the same time expressing their appreciation of the work of Mr R. Waddell.*
- (3) *That a sub-committee be set up to prepare a comprehensive list of the anomalies that exist in the Electricians Act, 1952, as it concerns the registration of radio servicemen, and that this report be presented to the Minister concerned with all pressure so that these anomalies may be removed or circumvented, thus facilitating the registration of qualified but unregistered radio technicians.*
- (4) *That this Association apply to the Director of Education to have established block short courses at the Seddon Memorial Technical College for the training of qualified but unregistered technicians to facilitate the registration of these people, similar to apprentices' block courses.*
- (5) *That this Association convenes a meeting of all interested parties, including manufacturers, Employers' Association, Wiremen's Registration Board, Trade Certification Board, retailers, the Commissioner of Apprenticeship, the Post and Telegraph Department, New Zealand Broadcasting Service, Director of Education, appropriate unions, technical press, etc., to discuss the problems associated with the registration of technical personnel and technical training methods.*

INTERFERENCE

The Wholesale Group discussed the question of the Association's obtaining representation on the Standing Committee on Radio Interference, and in view of the pending amalgamation with the other traders' associations in New Zealand, finally decided to bring down the following to the conference as a whole:

"The Wholesale Group wishes to advise the conference that there exists in Wellington a Standing Committee on Radio Interference, and that the New Zealand Radio Traders' Federation has a representative on this body. This Association has not been represented in the past, but wholesalers feel that we should have representation on the committee. In the event of amalgamation of the proposed four traders' groups, then we will automatically be represented, but should such amalgamation not take place, we should take steps to ensure that our Association is represented in the future."

FORMATION OF NATIONAL BODY

This question was briefly discussed, and the Wholesale Group decided that, provided the rules of the Association were adopted by the three new associations, it could not foresee any difficulty in bringing about the proposed amalgamation.

GENERAL

The Wholesale Group recommended to the incoming wholesale executive that the question of the importation of built-up amplifiers and electrical record-playing equipment be considered as early as possible; in the light of the growing demand for this equipment, and the effect on the New Zealand radio manufacturers of the low tariff protection on these goods, that the question be subsequently referred to the New Zealand Radio and Television Manufacturers' Federation for their consideration and comment.

Retail Section

DEALERS' LICENCES

Considerable discussion took place on the regulations governing the issuing of dealers' licences. These same regulations have been in force since broadcasting first started, and members considered that they badly needed overhauling, and that steps should be taken to protect the legitimate trader, and to prevent every Tom, Dick, and Harry from obtaining a licence by paying a nominal fee. On the question of how an approach to the Government should be made, it was decided that, as there were so many possibilities, it would be better for the incoming executive to look carefully into the matter after examining the existing legislation. It was resolved:

"That the matter be referred to the incoming executive for action."

MEMBERSHIP

A lively discussion centred round the question of whether the rules for admission to membership should not be amended to allow the entry to the Association of firms dealing only in electrical appliances and without facility for servicing them. The idea was strongly opposed by those members who had helped to frame the original rules on the ground that to admit firms of this nature would immeasurably weaken the Association. The whole object of maintaining the clause which made it necessary for a dealer in radios to make the necessary servicing arrangements was to protect the small man against the large chain stores and other businesses such as furniture dealers and stock companies. The chairman was very lenient in allowing open discussion, and at least fifteen members took part. Finally, it was resolved:

"That the terms of application for membership remain as they are."

PUBLICITY

The previous year's advertising campaign was reviewed, and discussion centred on whether a similar scheme should be repeated this year. It was considered

that the Association's emblem should be restricted to the use of those members who helped foot the bill for the advertising campaign. Later, in full conference, the following resolution was passed:

"That it be a recommendation to the incoming executive that it proceeds with an advertising campaign, and that a questionnaire be sent out with the minutes of the conference, seeking active support for this proposal."

MARGINS

The Retail Section dealt first with the question of the mark-up on radio. It was stated that a move was on foot in other parts of New Zealand, and actively supported by the Association, to ensure that all radios have a mark-up of 50 per cent. or £5, whichever is the greater. The retail group decided that the maintenance of this margin was essential, and that every effort should be made to have it brought about on a national basis. It was also considered that the question of margins should be placed before the New Zealand Radio and Television Manufacturers' Federation at their forthcoming annual conference, and that an application be made immediately asking the Federation to receive a deputation from the retailers, on a national basis, to discuss the question.

On recorder-grams and tape recorders, the retail group considered that a mark-up of 60 per cent. was essential.

On the question of parts, it was pointed out that many manufacturers failed to make available circuit diagrams of their sets. It was decided that this should be a matter for discussion at the manufacturers' conference, with a request that full circuit details for all makes of radios should be made available to the whole trade, on request.

NEW RADIO SETS

The matter of the unserviceability of new radios, when unpacked in dealers' shops, was discussed at some length. Previously, an attempt to obtain facts and figures had been made by the Association by issuing forms to members, asking them to give exact details of any new sets which opened up in faulty condition. Very few of these had been returned to the secretary, so that further representations to the manufacturers was not possible. It was resolved:

"That all members be exhorted to return radio repair forms as soon as possible to enable the information to be collated in time to go before the Manufacturers' Federation's conference."

SCALE OF SERVICING CHARGES

Messrs Boulton and Cleave had been charged, as a special sub-committee, to go thoroughly into the matter of servicing charges, and at the conference tabled a schedule which members considered most satisfactory. After discussion of some items and the making of a few amendments, the schedule was adopted by the conference, and the secretary was instructed to have 500

copies printed for circulation to members, the first copy to be free, and additional ones to be charged for.

EXPANSION OF RETAIL OUTLETS

At the 1956 conference of the association, it had been decided to see whether manufacturers supplying dairy companies with radios could not be persuaded to cease doing so. It was reported to the conference that this move had been successful in that the Bell Radio and TV Corporation had, in fact, stopped supplying sets to the New Zealand Dairy Co. Ltd. However, the executive had learned with much concern that another manufacturer had immediately stepped in and was supplying the dairy company with sets sold under the brand name of "Defiant." (Singularly appropriate name!—Ed.) Members felt that it was distinctly unfair on Bell Radio that they had succeeded only in giving the business away to another manufacturer in acceding to the Association's request, and that the Association should do all in its power to obtain redress for Bell Radio and TV Corporation. It was decided that the matter should be taken by delegates to the Manufacturers' Federation conference.

CAR RADIOS

It was admitted that the retail section of the radio industry had been somewhat lax in not trying much earlier to keep the distribution of car sets within the trade. It was well known to the trade that one firm making car radios, in an attempt to channel the marketing through registered dealers, had had to go out of production, and that unless something tangible was offered by the retail trade, no other wholesaler would be prepared to listen to any suggestion of keeping his activities confined to the radio trade. The members considered that even if garages or car distributors were in a position to offer car radios to the public, he should not be supplied direct from the factory, but through a local dealer, who in most cases would ask to install the radio and do the repair work on it.

FORMATION OF A NATIONAL BODY

The Retail Section decided to place on record its appreciation of the work of Messrs Wilson and Murphy, who had gone to a special meeting at Wanganui, with representatives of the other existing traders' associations, and had conducted negotiations so far. The Retail Section confirmed its opinion that a national body should be established, subject to the terms and conditions being finally agreed upon.

Resumption of Full Conference

After the individual sections had held the meetings reported above, the full conference was resumed, and commenced by the wholesalers reading to the full conference the resolutions that had been made. After general discussion between retail and wholesale members on those matters that were of common concern, the formal business of the conference was wound up by

(Continued on page 51.)

LETTER TO THE EDITOR

Sir.—There were eighteen members of the Association at a meeting held in Stratford last night, and under "general" on the agenda, five copies of your August issue of *Radio and Electrical Review* were tabled, opened on your Editorial, page two.

All members present were in agreement that perhaps a letter may clear things with regard to the general conditions of the radio retailer; it is unfortunate that you pick just on records. Why not car radios, electric razors, electric blankets, tax-free trading of power boards, etc?

You appear to be under some misunderstanding; this is surprising as you have sat in at conferences when things have been discussed; an Editorial after such a meeting would be more appropriate.

The radio retailers do not mind competition in records or any other field of radio, television, or electrical and home appliances, on the contrary, competition is the life of trade and fair competition is a very desirable thing.

We know the trend of overseas marketing (our news bulletin of twelve months ago proved this all too plainly) where overseas manufacturers no longer operate a franchise and operate a mobile vehicle at all hours of the night or day to advertise their wares direct to the public using the goodwill of established dealers who have rates to pay, donations to make, and general overhead worries of a static business to contend with.

But the thin end of the wedge is often gapped when a record distributor who enjoys a bigger coverage than most manufacturers amongst the record retailers in this territory, supplies only "hit" tunes to the chain stores, but expects all other dealers to handle his entire range of products and also to service them.

The side of the story that you neglected to mention in your Editorial is that all dealers were not asked to handle records prior to the chain stores being approached and the kick is twofold for a similar thing was done some time ago when the car radio was marketed through the automotive manufacturers, the radio dealers were given no option then except to service faulty units under guarantee.

The fact at present is that some manufacturers and distributors of agency lines are calling the tune and cutting the stomach out of prices, in short, they have entered the field of competition with retailers by selling at dealers' prices and often less direct to public bodies, Government purchasing organisations, education boards, automobile manufacturers, freezing works, oil companies, undertakers, garages, etc.

We know that fifty per cent. of radio technicians are poor business men because their lack of training in bookkeeping and ledger accounts, and that the same percentage are under-capitalised and cannot carry big stocks, but this should be no reason for the manu-

facturer to retail himself when a little help and advice could make good dealers for his products, or else define his policy of a manufacturing retailer and leave it clear cut.

To put it bluntly, there are too many manufacturers of radio cutting one another's throats and marketing themselves.

We have not the population to absorb the high pressure overseas selling methods and manufacturers are gearing their production too high, then cutting prices to justify their existence.

Manufacturers have for too long set the retailers' profit with no knowledge of what it costs to sell his products. They expect a dealer to exist on service departments but would not do so themselves.

It is a pity that "pop" records could not be supplied to the dealers before the broadcasting thrash the daylight out of them at every opportunity. So much excess stock would not then be found on so many dealers' shelves.

It is time the word "guarantee" was dropped. "Warranty" is the word and this does not mislead the buying public.

We in Taranaki feel that it is time a paid secretary/organiser was given the job to knock the radio trade into shape similar to the cycle and other trades. It would at that stage be interesting to see the actions of manufacturers.—Yours, etc., Taranaki Radio and Electrical Traders' Assn.

R. W. LAIRD,
Secretary.

* * *

New Representatives for United Kingdom and New Zealand Appointed by Narda

The Narda Microwave Corporation announces the appointment of two new overseas sales and service representatives. Aveley Electric Limited, Essex, England, has been appointed in the United Kingdom and W. G. Leatham, Ltd., Wellington, New Zealand, has been appointed in that country, according to an announcement by William A. Bourke, Narda's vice-president in charge of sales. Narda is a leading manufacturer of UHF and microwave test equipment.

Aveley Electric Limited, headed by Colonel J. D. Parker, is well known in the United Kingdom, representing several leading manufacturers of electronic instruments, among which is the West German firm of Rohde and Schwarz. The English firm's address is Ayrton Road, Aveley Industrial Estate, South Ockendon, Essex, England.

W. G. Leatham Ltd. is directed by W. G. Leatham, a qualified electrical and radio engineer with 14 years of service with Western Electric Co. in New Zealand. The firm also represents the Ampex Corporation, Redwood City, California.

ELECTRONICS— THE KEY TO AVIATION

Review of Radio Communication and Electronic

Exhibits at Farnborough

BY ANDREW REID

The importance of the electronic industry to aviation has never been so forcefully driven home as it is at this year's S.B.A.C. display at Farnborough.

There is no aircraft or guided missile here today that could operate without some form of electronic control. There is no airline in the world that could run with safety without the vital guidance of radio and radar. The air defence of Great Britain, now changing over to the guided missile, is utterly dependent on a network of electronics that extends from the initial detection of the enemy to the physical control, at thousands of miles an hour, of the missile itself.

The Minister of Supply, Mr Aubrey Jones, declared at the opening of the National Radio Show at Earls Court last week, that the electronics industry (exporting at the rate of more than £42 million a year) now played as large a part in the manufacture of guided weapons as the aircraft industry.

But electronic equipment is not confined to the operational side of aviation. The use of computers, capable of handling mathematics that are beyond the human brain, has resulted in more economical, safer, and more efficient aircraft. Even the operators of civilian air routes have come to depend on computers to help them towards more profitable operation of their routes.

The cost of producing an entirely new design of aircraft, whether civil or military, can be considerably reduced by the use of electronic methods of testing out new ideas.

An analogue computer, for instance, can be fed with information on a technical problem—say the stiffness and profile of a fin—and can then decide what factors of safety are called for under various conditions of loading and speed. It will propose to the designer a series of "ifs" and will then inform him of what would happen under a whole chain of hypothetical conditions.

In effect this means that an aircraft can be designed and practically "test flown" without a prototype being made. The bugs will have been taken out of it electronically before it gets into the air.

The success of the electronic engineers in two particular directions is worth stressing: the saving of weight and the design of apparatus that will withstand the high temperatures and acceleration forces involved in very high speed flight.

Economically, weight saving is vitally important.

One pound of unnecessary weight on a transatlantic airliner can cost the operator £1,000 in a full year of operation. Yet the operator is quite happy to carry in his aircraft several hundred pounds in weight of electronic equipment; it so improves the frequency and efficiency of operation that its use can make the difference between commercial success and failure of the airline. The more crowded the airlines become the more necessary are modern electronic aids.

The modern jet bomber, costing possibly £500,000 needs to carry too much electronic equipment that one reliable estimate put its cost at roughly one quarter of that of the whole aircraft.

On the production side, electronics are a major factor in the aircraft industry. Methods of testing materials by vibration, ultra-sonic techniques, the ability to obtain a comprehensive picture of the complete stresses on a structure by the use of strain gauges—these are now in everyday use. One manufacturer has proved that the use of a computer to make a mathematical re-arrangement of the flow of work through his machine shops has resulted in a saving of man-hours and an increase of output of several per cent.

* * *

Radio Component Show, 1958

The 15th annual Radio Component Show, organised by the Radio and Electronic Component Manufacturers' Federation, is to be held at Grosvenor House and Park Lane House, London, W.1, from April 14 to April 17, 1958.

Admission (from 10 a.m. to 6 p.m. daily) is by invitation only, applications for tickets to be made to the secretary, Radio and Electronic Component Manufacturers' Federation, 21 Tothill Street, London, S.W.1.

This year there is to be no special preview.

The Radio Component Show will overlap this time with the Instruments, Electronics, and Automation Exhibition (Olympia, London, April 16 to 25) in which members of the Radio Communication and Electronic Engineering Association will be exhibiting as well as some component manufacturers.

British radio and electronic components continue to be in great demand all over the world, and exports for the first half of 1957 show an increase of more than 20 per cent. on the figures for the same period last year.



John Gray

JOHN GRAY'S RECORD PAGE

RECORD OF THE MONTH

"Suddenly it's the Hi-Lo's". The Hi-Lo's with orchestra directed by Frank Comstock. Coronet KLP 593 (12-inch LP).

RECORD OF THE MONTH

With the ever changing ebb and flow of popular favourites we have noticed that vocal groups seem to have been less in the limelight of late: nearly all the hit parade records are by soloists. Crew Cuts and Gaylords have perhaps had their day, and even the shrieking "Teenagers" may soon be left behind in the search for something new and fresh. The latest group making a bid for the long- and short-playing spotlight are a foursome known as the Hi-Lo's, all of them nearer thirty than twenty in age, and making their local debut on a disc which should certainly be talked about. It will make an impression because the arrangements are both thoroughly professional and quite arresting, aided and abetted as usual by the acoustic gimmicks which seem quite unavoidable. The group themselves are difficult to classify, simply because they have added something of their own to the well-tried processes indulged in by such combinations. You can judge this from their seemingly outrageous arrangement of the "Desert Song", which comes rather close to Spike Jones, but remains highly enjoyable in its own right. Their impish humour also illuminates "My Sugar is so Refined". Other numbers given the Hi-Lo treatment include such standards as "Deep Purple", "Love Walked In", "Basin Street Blues", and "Swing Low Sweet Chariot". This is an attractive record, not least because you never know what they are going to do next.

Some of the "newer" material being put out under the Festival label takes us back in time, right to the pre-Hi Fi

MEMORIES OF THE THIRTIES

era, thus renewing memories for older folk and introducing younger collectors to the outstanding performers of a fast-receding period. Such reflection is prompted by the issue of FR 12-1405 ("Porgy and Bess") and FR 12-1157 ("Grace Moore Sings"). "Porgy and Bess", produced on Broadway in 1935 as a folk opera, has now found its way into the reference books and into the repertoires of quite a number of dignified theatres; it remains one of the most compelling works of the American stage. With the temporary disappearance of the more recent complete recording, admirers of "Porgy" could do worse than turn to this very interesting souvenir of the original production, wherein the main vocal highlights are presented by the cast which first sang it, with Todd Duncan and Anne Brown in the leads. This opera was undoubtedly the most important product of the combined talents of George and Ira Gershwin, and the record makes a living piece of stage history.

The fascinating career of Grace Moore, which came to a tragic end in an air crash in 1947, made millions of people opera-conscious. Her almost sensational film "One

Night of Love" started off a cycle of pictures with operatic backgrounds that has not really finished yet, and her own appearances in real opera, at the Metropolitan, Covent Garden, and elsewhere, drew thousands of people who would otherwise, perhaps, never have ventured within such august and hallowed portals. Grace Moore's autobiography "You're Only Human Once" is worth reading for the amusing light it throws on a career which kept one foot in both musical worlds. She was an extraordinarily gifted woman, possessor of a sumptuous soprano voice and, as many have testified, a devastating personality. The present record dates from the time when her career was at its height and ranges from operatic arias of Puccini to some of the Kreisler melodies she sang in her film "The King Steps Out". It should be keenly welcomed, even though the recording as such would never win any kind of prize nowadays.

The Emory Cook "Sounds Of Our Times" series has turned up again. This is an interesting by-product of the

SOUNDS OF OUR TIMES

record industry today; a series of discs specifically made to cater for people who want to test their equipment to the uttermost. Such is undoubtedly the reason for the issue of Cook 1070, entitled "Rail Dynamics", which has been rhapsodically described as "... beautiful and haunting sounds of a railroad reaching out over a wet, foggy night", and also as "... so real it makes listeners duck". You may prefer to be aurally assaulted by a "Brute Force Steel Band" from the Caribbean (Cook 1042) or, the ultimate horror, by a Gaelic Pipe Band in full blare ("Kilts on Parade", disc 1025). More specifically musical is a delightful harp record by Edward Vito (1030), some impressive organ records by our old acquaintance Reginald Foort (try disc 1053 with its "In a Persian Market" and other favourites) and some real flamenco playing from guitarist Carlos Montoya (disc 1028).

From the same distributors comes a really delightful disc by the "Little Gaelic Singers". The vogue for children's choirs is still very much with us, but there are remarkably few of such combinations, considering the huge demand, hence there will be a welcome for this fine Polydor disc which is appropriately called "From Donegal to Galway Bay", the number being LPHM 46031. There is an attractive cover to whet our appetite for the items inside, and all who are inclined to investigate it will find themselves on familiar ground with "Dear Old Donegal", "Mother Machree", "Rory O'More", and others, including, of course the inevitable and seemingly indispensable "Danny Boy". The singers, we might add, are a genuine Irish children's choir. In rather different vein (LPHM 46037) is "Plenty Valente". Those who eagerly bought Caterina Valente's single discs can now welcome her on LP, the more so as this new disc does not appear to duplicate any of her previous issues on the 78 speed.

“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 21st SEPTEMBER, 1957

Title	Artist	Position last week	Record Make
1 Dina	Paul Anka	1	Columbia
2 Love Letters in the Sand	Pat Boone	2	London
3 Last Train to Fernando	Johnny Duncan	3	Columbia
4 Island in the Sun	Harry Belafonte	4	R.C.A.
5 With All My Heart	Petula Clark	6	Nixa
6 Water Water/Handful of Songs ..	Tommy Steele	5	Decca
7 Wanderin’ Eyes	Charlie Gracie	8	London
8 All Shook Up	Elvis Presley	6	R.C.A.
9 Paralysed	Elvis Presley	9	R.C.A.
10 Tammy	Debbie Reynolds	10	Coral
11 Jenny Jenny	Little Richard	16	London
12 Stardust	Billy Ward	20	Festival
13 Bye-Bye Love	Everly Brothers	11	London
14 That’ll Be the Day	Crickets	—	London
15 Puttin’ on the Style/Gamblin’ Man	Lonnie Donegan	13	Nixa
16 Teddy Bear	Elvis Presley	12	R.C.A.
16 Fabulous	Charlie Gracie	14	London
18 Any Old Iron	Peter Sellers	20	Parlaphone
19 Short Fat Fannie	Larry Williams	—	London
19 Passing Strangers	Billy Erskine and Sara Vaughan	—	Mercury

Stebbing and Zodiac records were part of the early history of local record-making, and their re-appearance within the last few weeks shows that New Zealand, too, can produce souvenirs of the past—in this instance, of course, the past is not so far removed from

SIGNS FROM THE ZODIAC

the present. Memories are revived by these Bill Wolfgramm records, notably by the well remembered coupling of “Maui Girl” and “Maui Chimes on Z 1003, and Daphne Walker’s “Polynesian Love Song” and “Hawaiian War Chant” on Z 1004. The W & G releases offer further transfers from overseas lists, including some originating in Australia, Stan Stafford’s “Frankie and Johnny” (WG SL 425) for instance, and an amusing number in “Spinning, Spinning, Spinning”, which of course refers to discs rather than textiles (Terry and the Macs, WG SFB 296). W & G also branches out into the classical field with a version of the Brahms first symphony by the Oslo Philharmonic Orchestra under Odd Gruner-Hegge (WG AAC 354) and a one-record condensation of the highlights from Tchaikovsky’s opera “Eugene Onegin”, performed by soloists, choir, and orchestra of the Dresden State Opera under Fritz Schreiber on WG AAC 337. In lighter vein comes a collection of Richard Rodgers show tunes as done by various singers, together with David le Winter’s Orchestra, and including some of the lesser-heard tunes such as “That’s For Me”, “So Far”, and “You Took Advantage Of Me” (WG BMC 356).

During the last few years a species of musical archaeology has become a regular, and seemingly profitable, activity

DIGGING UP THE PAST

on the part of most recording companies whose activities extend back over a long period. This involves the re-furbishing and re-issue of all sorts of material originally issued in the past. The greater part

of it is concerned with “Golden Age” vocal and operatic records, but the majority of these have, for a variety of reasons, remained obstinately unavailable to New Zealand buyers (though I hear Philip Warren did manage to import a few of the celebrated re-issues put out on the “Scala” label, all of which speedily vanished into the possession of astute collectors). For obvious reasons, little other than vocal material has survived from the early years of the century. Now the HMV group have delved a little nearer our own time and are re-issuing, with new labels and new numbers, some of their most prized instrumental and symphonic recordings of the period preceding and immediately following the war. This was a good period, both for performance and recording itself, even though the best 78s of those times show up poorly by modern reproducing standards. A start has been made with the five Beethoven piano concertos as recorded by the now legendary Arthur Schnabel, and issued on a special series with a COLH prefix. The earliest of these is the first, C major, concerto, recorded originally in 1932, but the others are post-war and one of them, the third, C minor, concerto with the Philharmonia under Dobrowen, has never previously been released in any form, ostensibly because one tiny technical blemish caused Schnabel’s refusal to sanction the release in his lifetime. This highly interesting disc is now issued as COLH 3. Others in the series include the six Brandenburg concertos of Bach, in the unforgettable renderings by the Adolf Busch Chamber Players, performances which in some ways haven’t been surpassed even yet (COLC 13-14) and the Beethoven violin concerto as recorded by Kreisler on HMV (COLH 11).

For the Serviceman

THE "PACEMAKER" TRANSISTOR PORTABLE

Description of Circuit

The circuit, generally, comprises a superheterodyne with a tuned radio frequency stage, a crystal diode demodulator, and a three-stage A.F. amplifier with the final push-pull stage operating class "B".

The separate sections of the receiver are fairly conventional and follow quite closely standard electron tube practice. Apart from the impedance transformations involved in the coupling units, particularly those of the R.F. and I.F. sections, to contend with operating conditions of transistors, there are other special features incorporated which contribute valuably to the outstanding performance of the receiver. These features, along with a stage by stage description are mentioned below.

It should be appreciated that transistors are current amplifiers and because of the low operating voltages, the currents concerned in both input and output circuits connected to them are relatively high. The impedances of the terminals of transistors in the common emitter connection as used in this receiver are similarly extremely low in comparison to pentode or tetrode valves and quite high ratios are required in coupling the tuned circuits efficiently and to ensure the requisite magnitudes of signal currents. Other than these special characteristics, the transistors as employed in the receiver have a functional application and behaviour similar to the triode valve.

The highly developed R.C.A. Drift transistors (2N247) used in the R.F. and mixer stages have an extremely low value of base/collector capacitance which makes neutralisation simple and non critical and furthermore, the value is much more of a constant factor than in conventional transistors with changes in base current to the point that full and completely stable A.V.C. control is possible.

The input circuit is comprised of a high "Q" coil and ferrite rod. This is followed by a type 2N247 transistor in neutralised grounded emitter connection. Signal input to the base is via a tertiary winding closely coupled to the main winding. This circuit is tuned by a section of the variable condenser in the usual way.

Steady operating bias for the transistor is obtained in part from the emitter resistor and by an appropriate value of battery bias as determined by a potential divider comprising resistors R12 and R13. Some self bias results from the drop in base filter resistor (R1) and the diode load and filter resistors. The normal no signal emitter current of this stage is .4 to .45 ma.

The output circuit comprises a high "Q" dust cored coil with a 50% tap for the collector. This is the 1st I.F. stage transformer and is single tuned by a 500 pf condenser and the adjustable core. Base current for the I.F. stage transistor is fed from a close

coupled tertiary winding of approximately 10% total turns. Steady operating bias is obtained in the same manner as for the R.F. and converter stages.

The three base feeds for the R.F. converter and I.F. stage transistors have a common supply from A.V.C. filter resistor R10, and the demodulator diode load comprising R11 and R12. A fair order of base current flows in this circuit at all times and under no signal conditions, it approximates 30 μ a. The total value of resistance in this common circuit is thus an important factor in establishing the correct value of operating base current.

The collector of the I.F. stage transistor (Q3) is series fed from one end of a centre-tapped dust core coil of similar characteristics to the input transformer of the same stage. Neutralisation is effected by capacitive feed-back from the free end of the coil through adjustable trimmer C24.

The working gain of the I.F. stage is high and the intrinsic feed-back capacitance of the transistor requires to be accurately balanced out to avoid unwanted regeneration and excessive side-band cutting. The adjustments of both neutralising condensers are dealt with later in this bulletin.

The I.F. output from Q3 is taken via a close coupled tertiary winding in the I.F. coil and feeds a crystal diode rectifier. The A.F. component of the rectified I.F. carrier is passed on to the A.F. amplifier via the volume control (R15). The D.C. component as developed across diode load (R11) and voltage divider (R12) (R13) is fed to the bases of R.F. converter and I.F. transistors opposing the steady negative bias, for full A.V.C. control.

It should be appreciated that the order of total base current flowing in the diode circuit would be such as to bias the crystal diode to a non conducting state, and thus signal rectification could not occur below an amplitude where the peak value of the I.F. carrier matched the opposing bias. The voltage divider (R12) (R13) provides the means of unifying the D.C. potentials at the diode terminals and thus its normal conducting condition. The voltage divider, also, largely establishes the normal working point of the R.F., converter, and I.F. transistors as previously mentioned, with no signal collector currents of approximately 380-420 micro amps each. Under A.V.C. control the figure will reduce and in the case of strong local signals, may have a value of 30 to 50 μ a. each.

Separate oscillator injection is employed, both to realise the maximum conversion gain and to permit A.V.C. control because of the heavy reduction in transistor transconductance which would result under strong signals.

The local oscillator employing an R.C.A. 2N219 Transistor (G4) is of quite conventional form using

a common base circuit. The collector is series fed from a tap on the tuned winding. Emitter feed is via a close coupled tertiary to provide the feed back. Oscillation is vigorous and is well maintained over the operating frequency range with a battery supply down to 2 volts approximately. A separate injection winding feeds the emitter of the converter stage at a level ensuring optimum mixing and maximum conversion gain. The variable padding condenser (C10), is in the "hot" end of the circuit and any adjustment to this should be undertaken with a non-metallic screw driver, to avoid unwanted added capacitance.

The A.F. amplifier receives its input from the crystal rectifier as previously described, via the volume control (R15), and a matching resistor of 4.7 K (R16). The first stage (Q5) is D.C. coupled to the following driver stage via the collector feed resistor (R21) and matching resistor (R23). Steady bias for the base of the first stage is via a divider across the battery supply comprising resistors (R17) and (R18). Steady bias for the second stage is obtained from the collector feed and matching resistors and the base shunt resistor (R24).

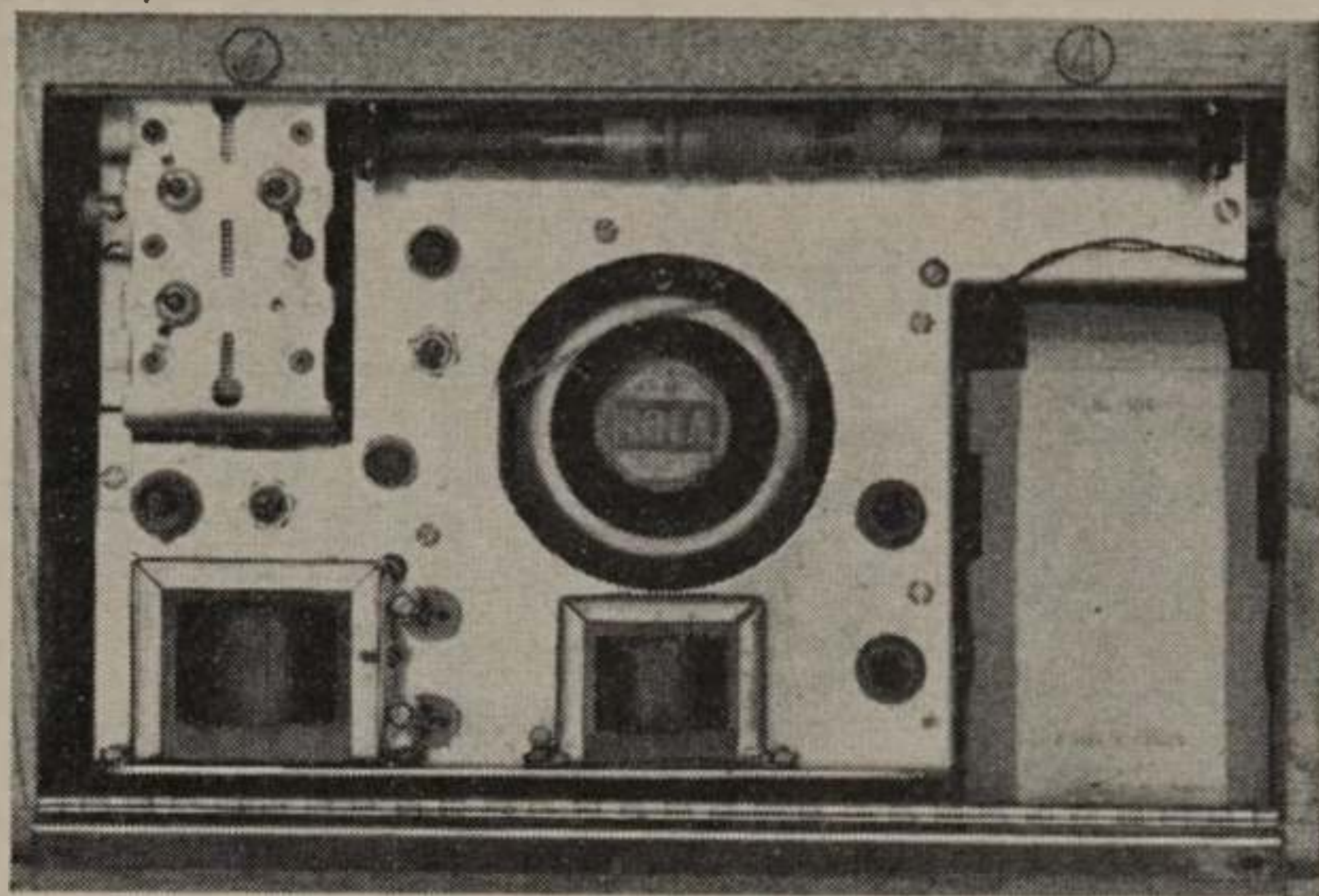
There are two additional side circuits associated with the first stage amplifier. One of these is the common connection between the emitters of Q5 and the output stage (Q7) (Q8), via R20. This is a D.C. loop and provides for the temperature and voltage stabilisation of the output stage.

The second side circuit concerns the collector feed of Q5 and is for the purpose of introducing negative A.F. feed-back over the driver and output stages. The collector feed in this case is fed from a divider across the loudspeaker voice coil comprising resistors (R29) and (R22). The effective gain reduction of this feed-back is 7 db and is an important factor in the high standard of reproduction attained.

The A.F. output of driver stage (Q6) is transformer coupled to the output stage (Q7) and (Q8). This stage is biased to a low value of quiescent current and operates as a class "B" amplifier.

Operating base bias for the class "B" stage is obtained from the drop in common feed resistor to the A.F. amplifier stages (R28). The value of this resistance is adjustable and thus the normal working current of the stage and the total drain of the whole receiver, is substantially regulated by its setting. No adjustment of this resistor should normally be required. Replacement of transistors Q5 and Q6 or of resistors associated with these stages could result in some total current change, in which case the total battery current would indicate the possible need of readjustment to the nominal value of 9 m.a. with a battery terminal voltage of 6 volts.

Output of the power amplifier feeds the loudspeaker in the usual way and an U.P.O. of 300 milliwatts is available with a battery voltage of 6 volts. A feed from the voice coil is taken via R29 to the collector of Q5 to provide negative a.c. feed back as previously mentioned.



Top chassis view of the Receiver.

The temperature and voltage stabilisation already referred to operates by virtue of inverse D.C. feed-back. Any steady emitter current increase in the output stage, resulting in an increase in the normal quiescent current in the stage, increases the voltage drop in R27. The resulting negative going potential applied to the emitter of Q5, reduces the latter's transconductance and through the D.S. coupling that of Q6 also. This results in a reduced current through R28 with a close restoration of normal current condition in R27. Steady battery voltage variations result in a similar measure of control and thus the optimum working point of the class "B" stage is safely maintained under all conditions and over a wide range of battery voltages.

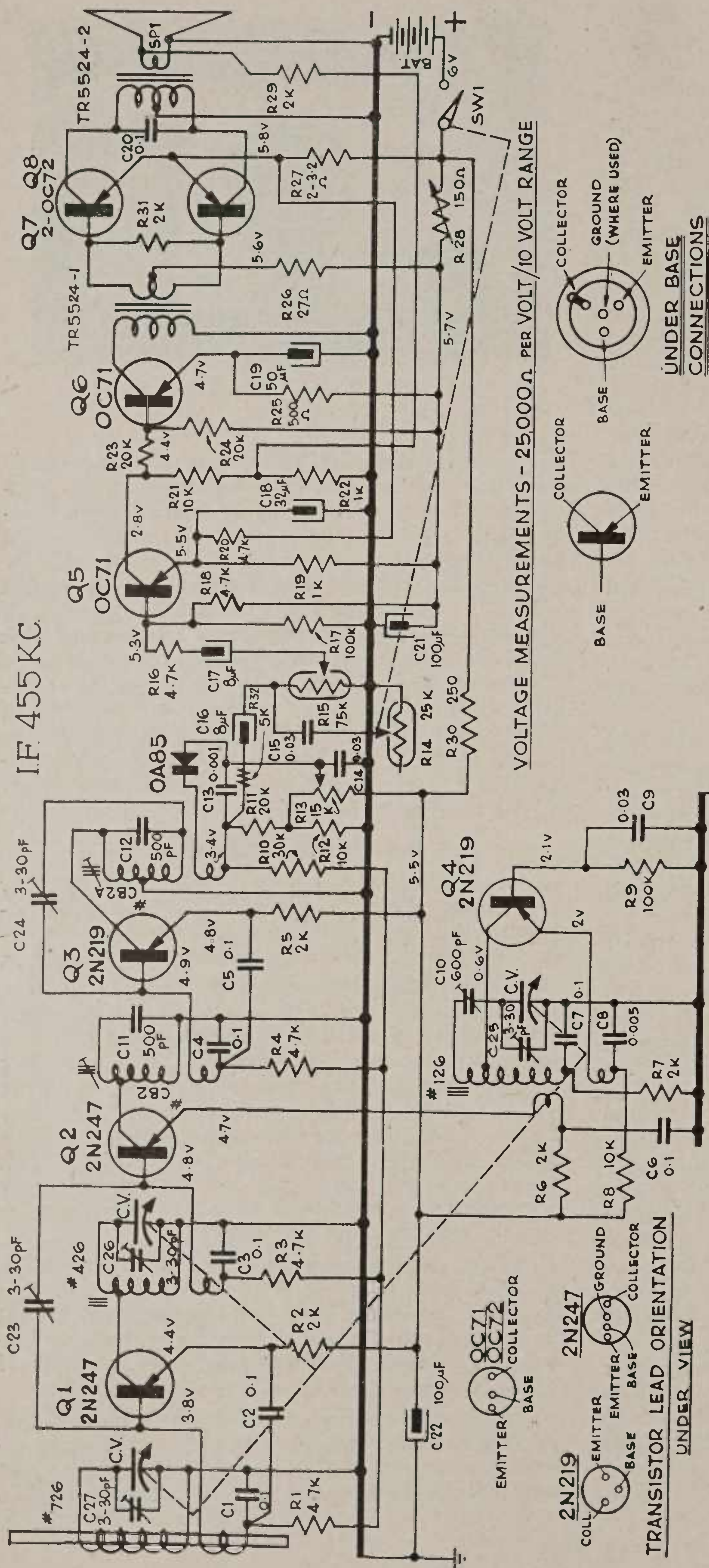
R.F. Section Alignment

The normal factory settings should hold good for an indefinite period. The routine of adjustments together with recommended test points is described below, assuming normal conditions in the A.F. amplifier.

Before checking alignment of the I.F. transformers, the setting of the code diode biasing pre-set resistance (R13) should be checked. If random noise output is possible, the correct adjustment is that providing maximum noise output. Alternatively, a D.C. voltmeter of 1 to 3 volts full scale with an internal resistance of 10 to 20,000 ohm per volt, clipped across the diode, will show zero volts with the correct adjustment. This adjustment is not critical and once set will hold good for an indefinite period for a given set of transistors in the R.F. converter and I.F. stages.

The I.F. amplifier may be checked or aligned using an A.F. output meter in the usual way. Signal input should be fed to the base of the converter (Q2) via an isolating capacitor of .1 mfd. approximately. Unmesh the variable condenser, and with a signal of 455 Cc/s, adjust the I.F. coil cores as required.

The I.F. stage neutralising condenser is fairly critical and if widely out of adjustment, may exert some influence on the tuned circuits. Neutralisation is most easily effected by observing the character of random



noise while adjusting the trimmer above and below the stable state. The setting which results in a smooth sharp hiss is the correct one. Alternatively, the S.G. may be rocked a few Kc/s and the sideband responses checked in the usual way for absence of regeneration.

Any material change in neutralising capacitance will necessitate some readjustment of the I.F. coil cores and the fixed frequency adjustment should be rechecked for a single peak output.

Adjustment of the signal circuits follows regular practice. Dial calibrations are established with the condenser fully meshed and with the cursor and dial diametral line in register. The dial disc is held friction tight to the condenser spindle and may be rotated or completely withdrawn as required.

H.F. trimming adjustments should be undertaken at approximately 1400 Kc/s and L.F. padding at 600 Kc/s. Signal input for aligning converter and oscillator

circuits, is most easily achieved by clipping the generator directly to the aerial circuit section of the tuning gang. Thereafter, the aerial circuit is aligned using random noise as the signal source and evidence of peaking.

R.F. stage neutralising is non critical and the factory setting of the compression trimmer should hold good under all conditions and for an indefinite period.

A.F. Section Adjustments

The audio frequency section has only one adjustment which could materially affect the performance of the receiver. This is the quiescent or no signal current setting of the output stage. The adjustment is made with R28 and the measurement is the total no-signal battery current of the whole receiver. For a battery terminal voltage to 6 volts and at an ambient

(Concluded on page 36.)

TRADERS' ASSOCIATION CONFERENCE*(From page 43.)*

the election of officers for the ensuing year. The following group executives were elected:

President.—There being only one nomination for the position of President, Mr Garth Wilson was unanimously elected. In accepting the position, Mr Wilson stated that it was with regret that he had found it necessary to withdraw from his position as chairman of the Retail Section, but he would be only too happy to continue to serve the Association both on the Retail Section Executive and in the position of President.

Group Executives.—The following nominations were reported:

Wholesale Section—Chairman: D. Black (Fisher & Paykel Ltd.); Executive: W. J. Murphy (Ultimate-Ekco Ltd.), H. Barr (Wingate & Co. Ltd.), R. Walker (Autocrat Radio), B. M. McRobie (National Carbon

Ltd.), A. Staff (Pye (N.Z.) Ltd.), C. R. Peoples (C. R. Peoples Ltd.); representatives on Board of Directors: W. J. Murphy, H. Barr, R. Walker, and A. Staff.

Retail Section—Chairman: A. C. Boulton (Paeroa); Executive—Metropolitan area: G. Wilson (Elco Radios Ltd.), L. W. Knox (Wisemans Ltd.), D. Stradwick (Bond & Bond Ltd.), I. MacLeod (Mt. Albert), D. Alexander (Farmers Trading Co.), B. Lofley (Mt. Roskill); Provincial area: F. O. Cleave (Hamilton), deputy, C. A. Jackson; A. C. Boulton (Paeroa), deputy, D. Heathcote; R. Oxenham (Whakatane), deputy, R. Spence (Rotorua); A. Blarenberg (Tauranga), deputy, J. Veitch (Te Puke); B. Robson (Hamilton); G. Vicary (Otorohanga), deputy, F. Miller (Te Awamutu).

STEREOPHONIC SOUND*(From page 22.)*

lic is as yet much more used to buying recorded music in disc form than as tapes. Because of this, various companies are experimenting to produce some form of twin-track disc which can be used for stereophonic reproduction. We believe that A. R. Sugden Ltd., makers of the well-known "Connoisseur" gramophone motors, have a system which they are about to put into production, but we must admit that this is only hearsay as yet.

There are two obvious methods of producing twin-track discs. One is to have two spiral grooves instead of one, with the turns of one spiral inside those of the other. Two separate pick-up heads, or a special double one could then be used to take off the outputs of the tracks simultaneously but entirely separately.

Another method that has been experimented with is to have only one groove, modulated laterally (as for ordinary records) for one track, and vertically, in hill-and-dale fashion, for the other. It is not possible to get complete separation of the outputs of the two tracks by this method, because of the great difficulty of making a laterally moving pick-up with no pick-up at all due to vertical movements, and vice-versa. It has been stated, however, that since the programme material on each channel is identical, a certain amount of cross-talk between them can be tolerated, because it will do no more than slightly debase the stereophonic effect.

There are other problems, however, and in our opinion, anyone who succeeds in engineering any satisfactory form of dual-track disc recording and reproduction will have been in for a tremendous amount of research and development work, with the probable result that the stereophonic disc will be just as expensive as a dual-track tape, if not more so.

RECORDERGRAM*(From page 30.)*

If we seem to have laboured the point somewhat, it is only because it is so important. Indeed, if the earthing is not properly carried out, the whole thing can become quite useless, so no one can now say that he hasn't been warned!

(To be continued)

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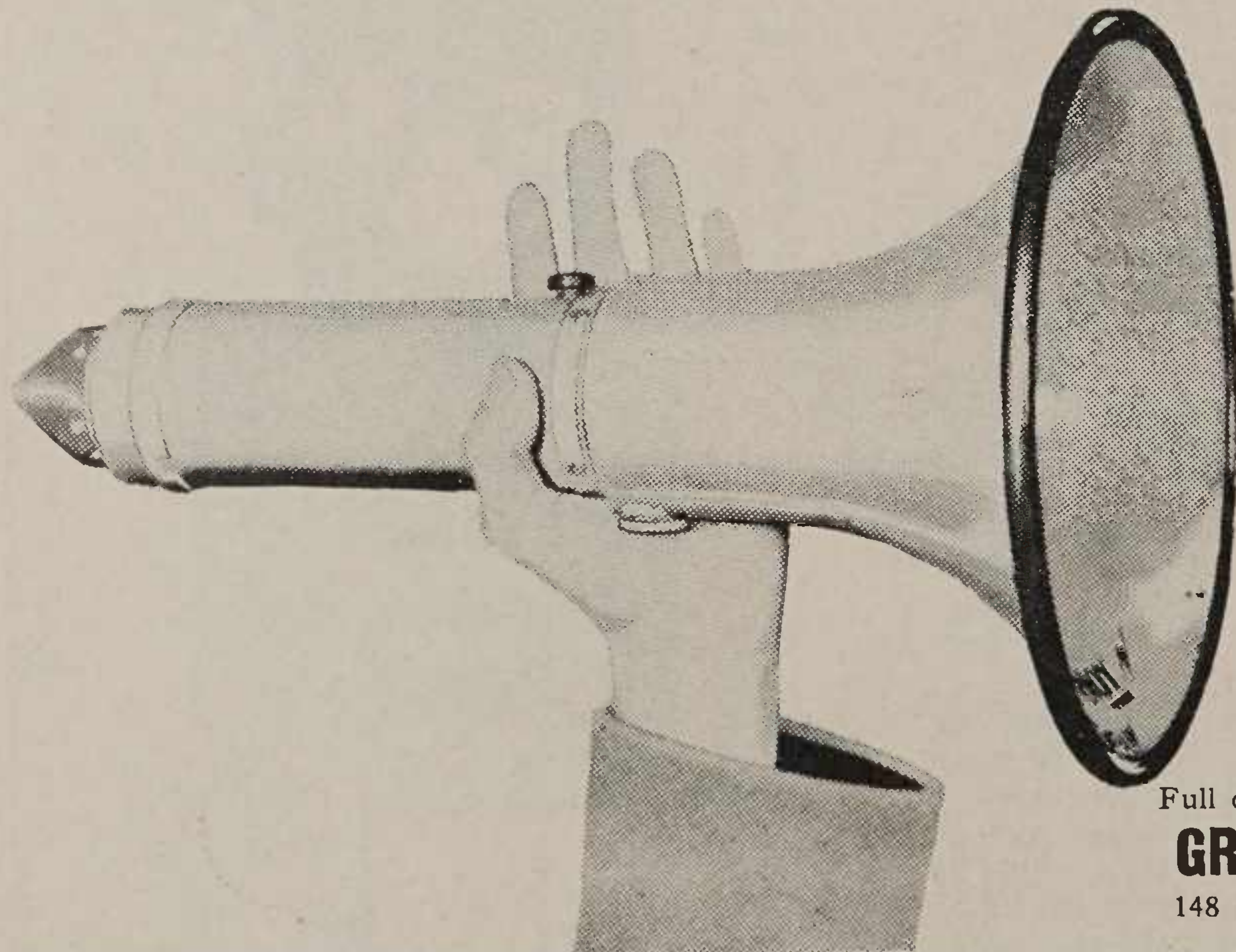
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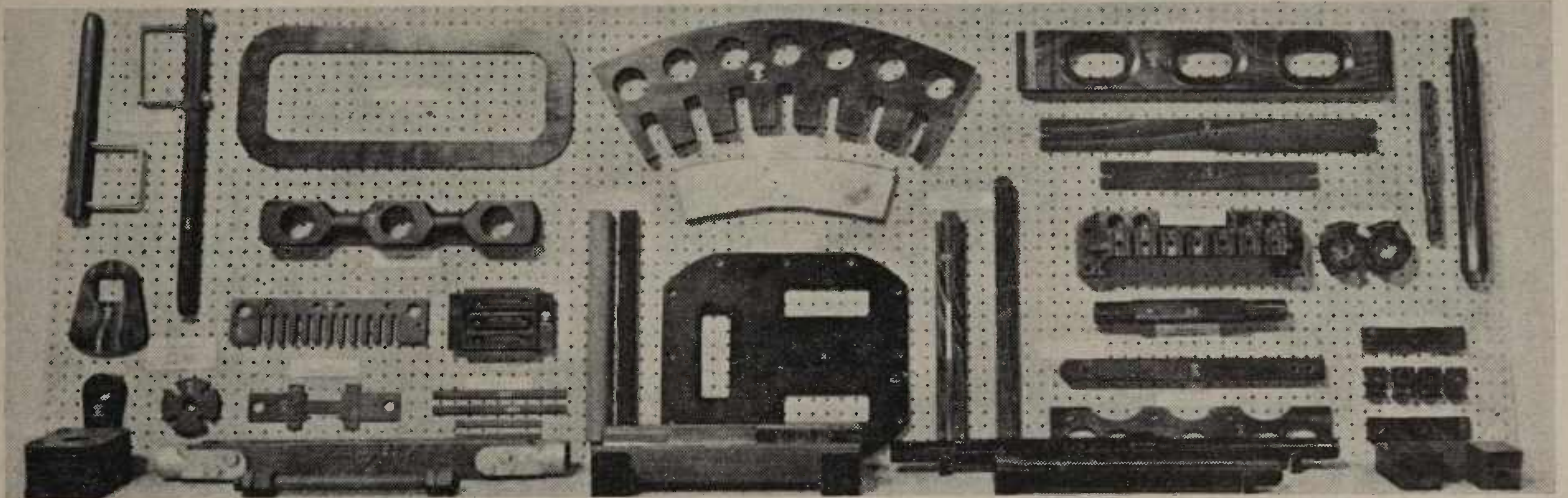
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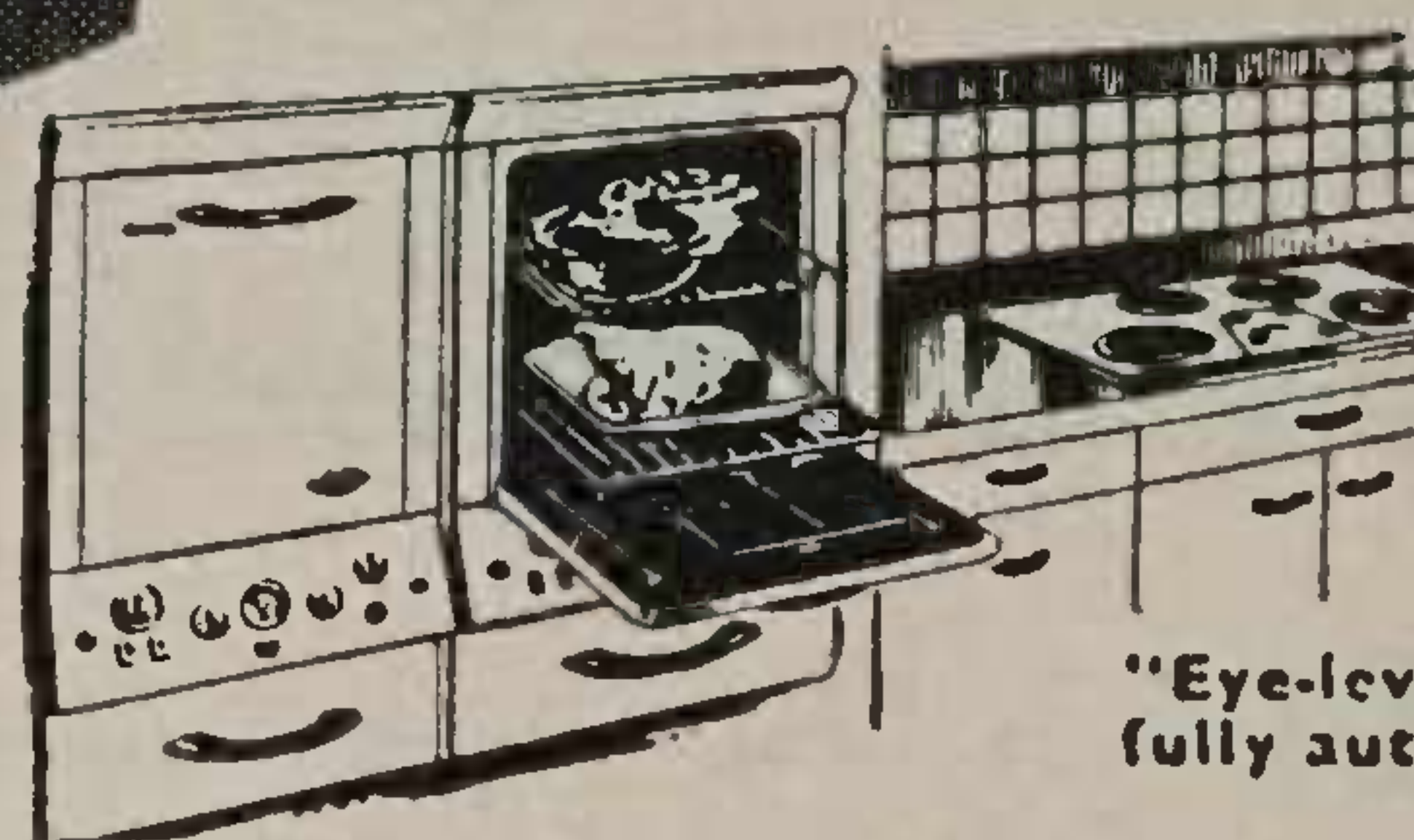
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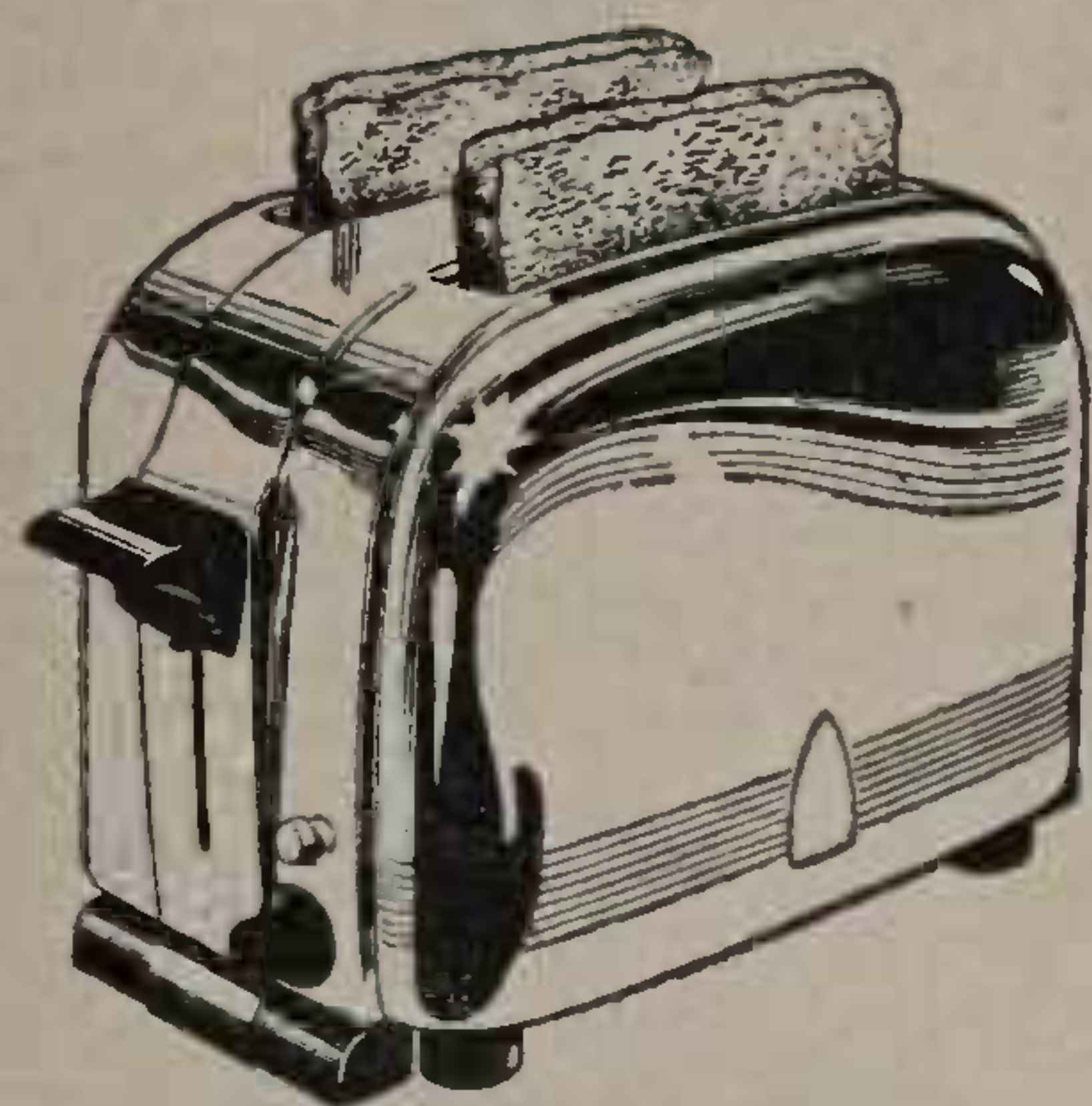
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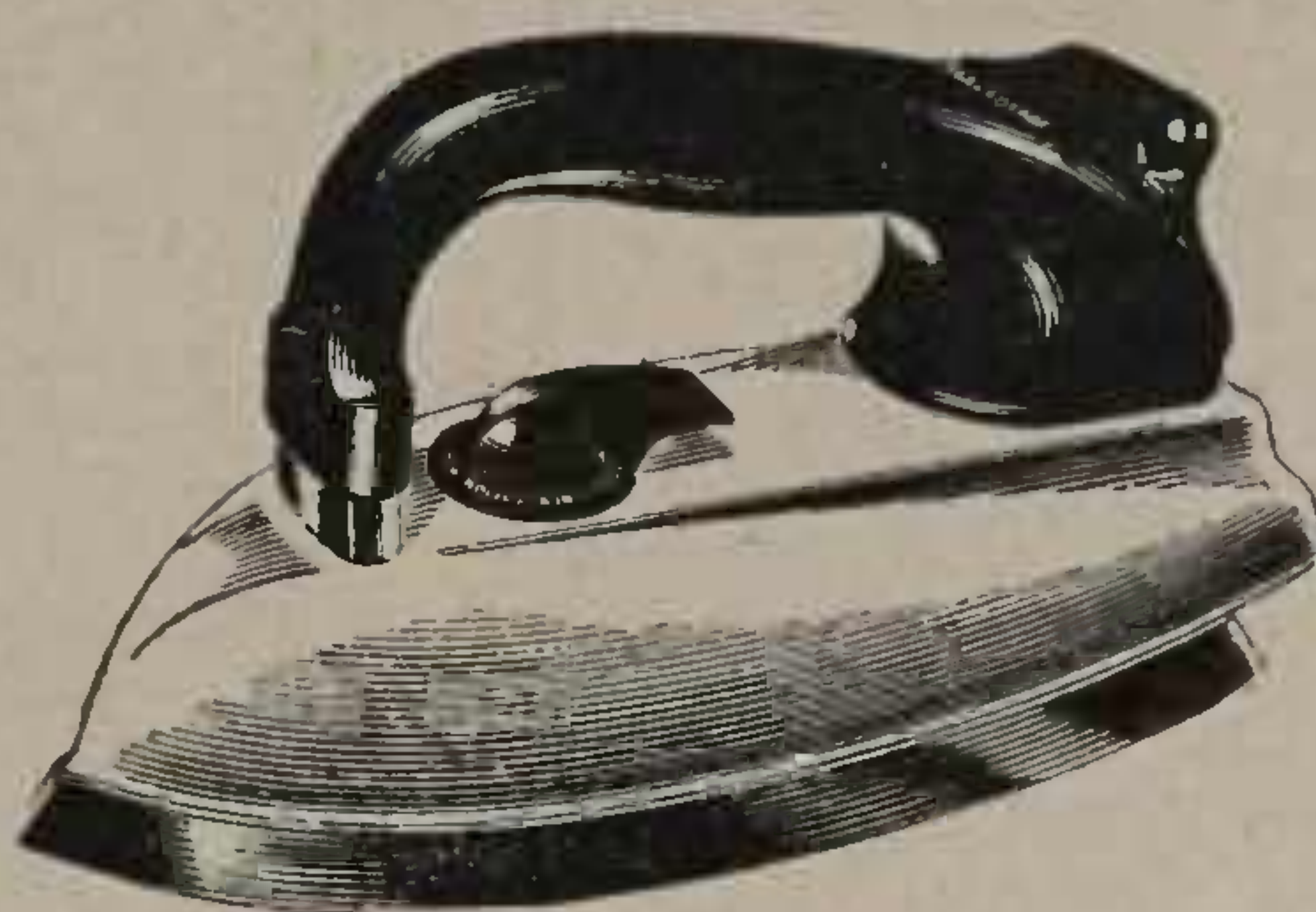
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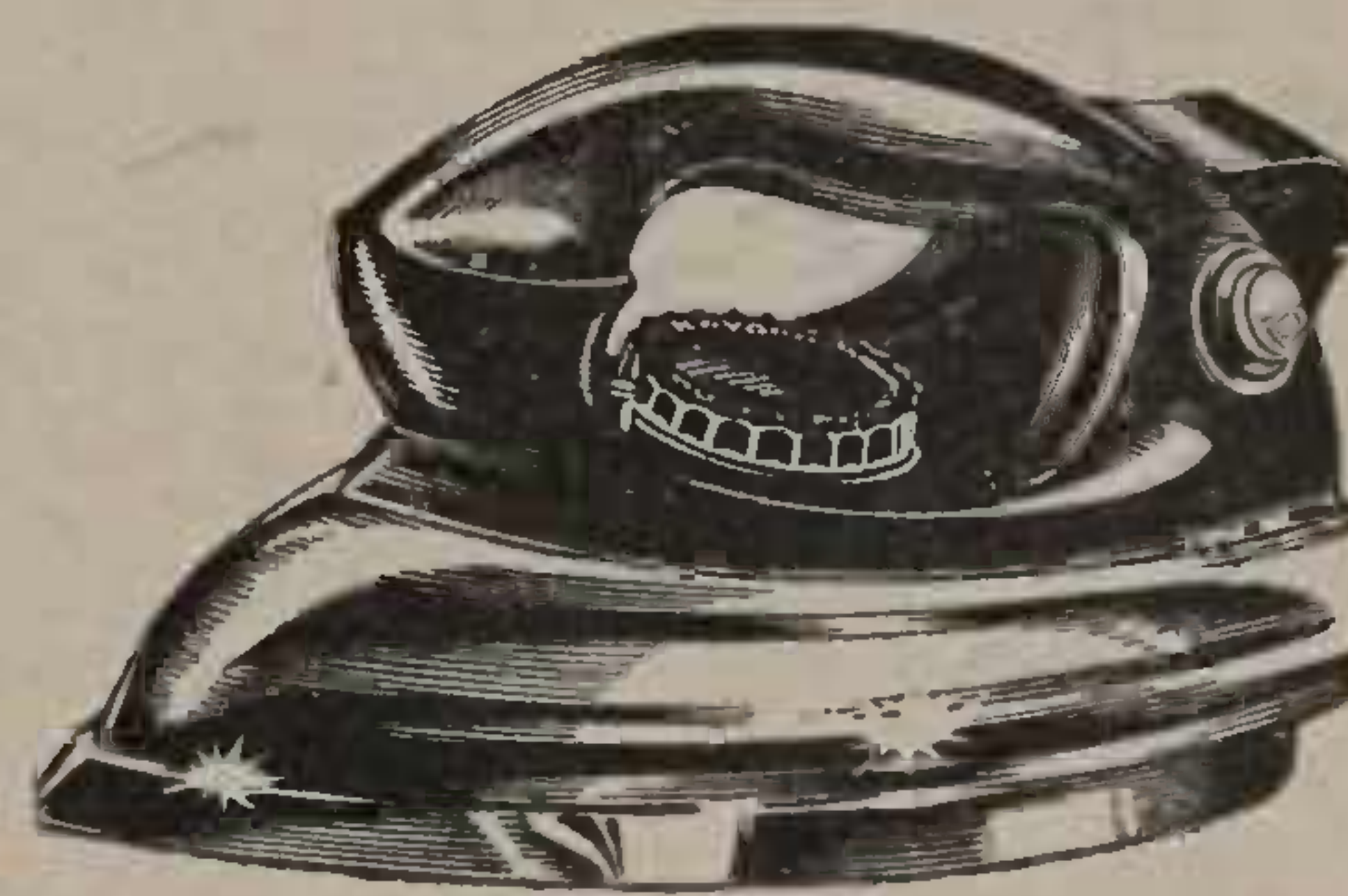
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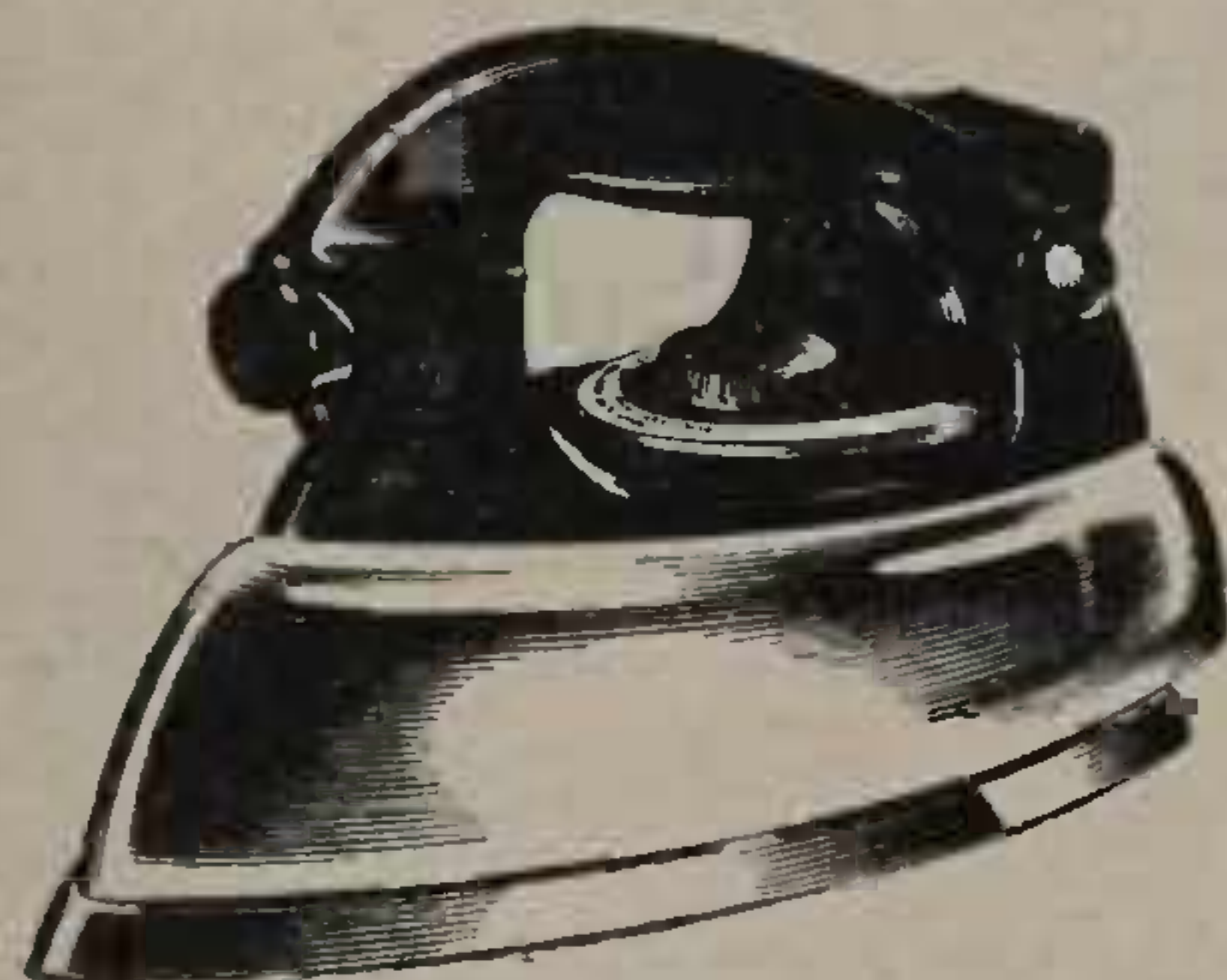
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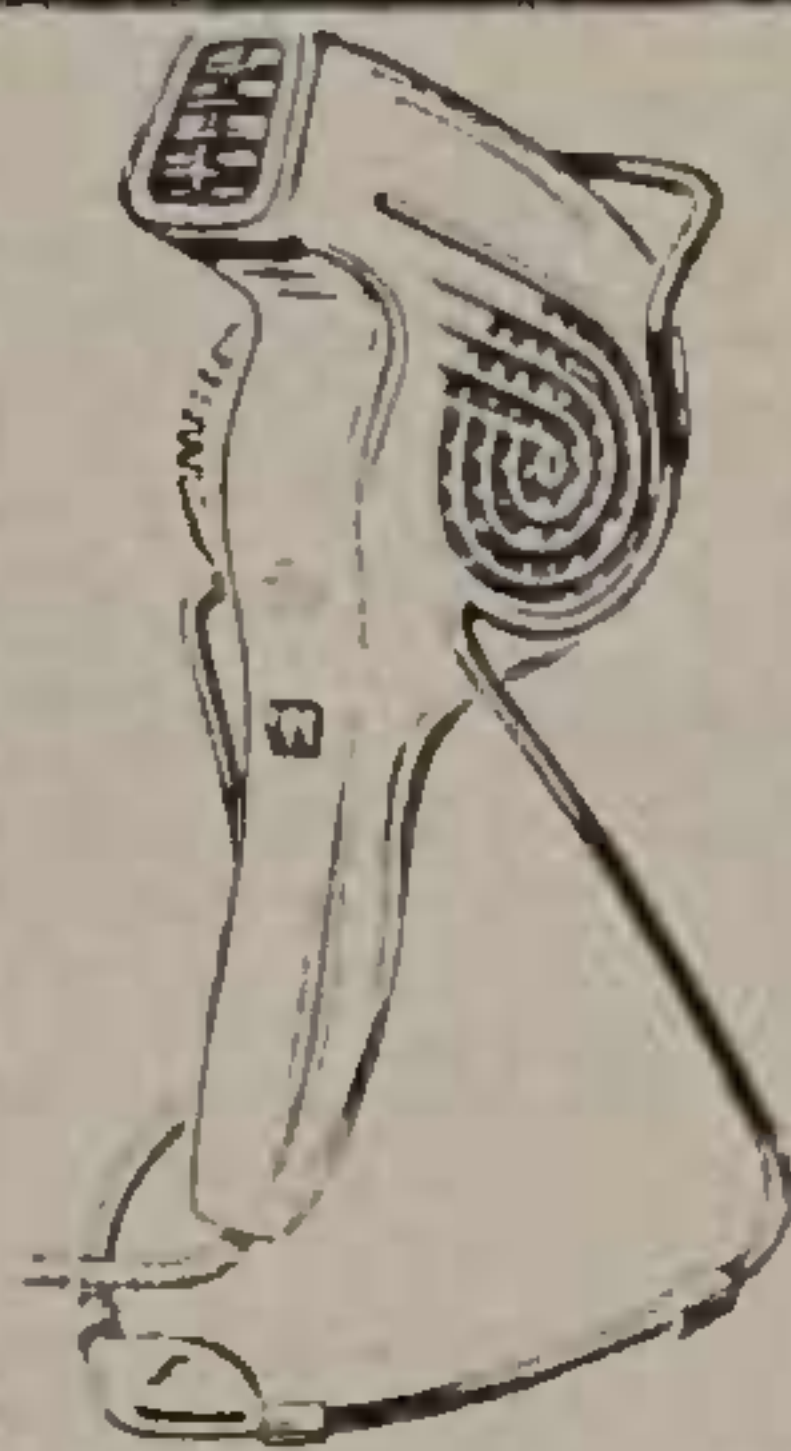
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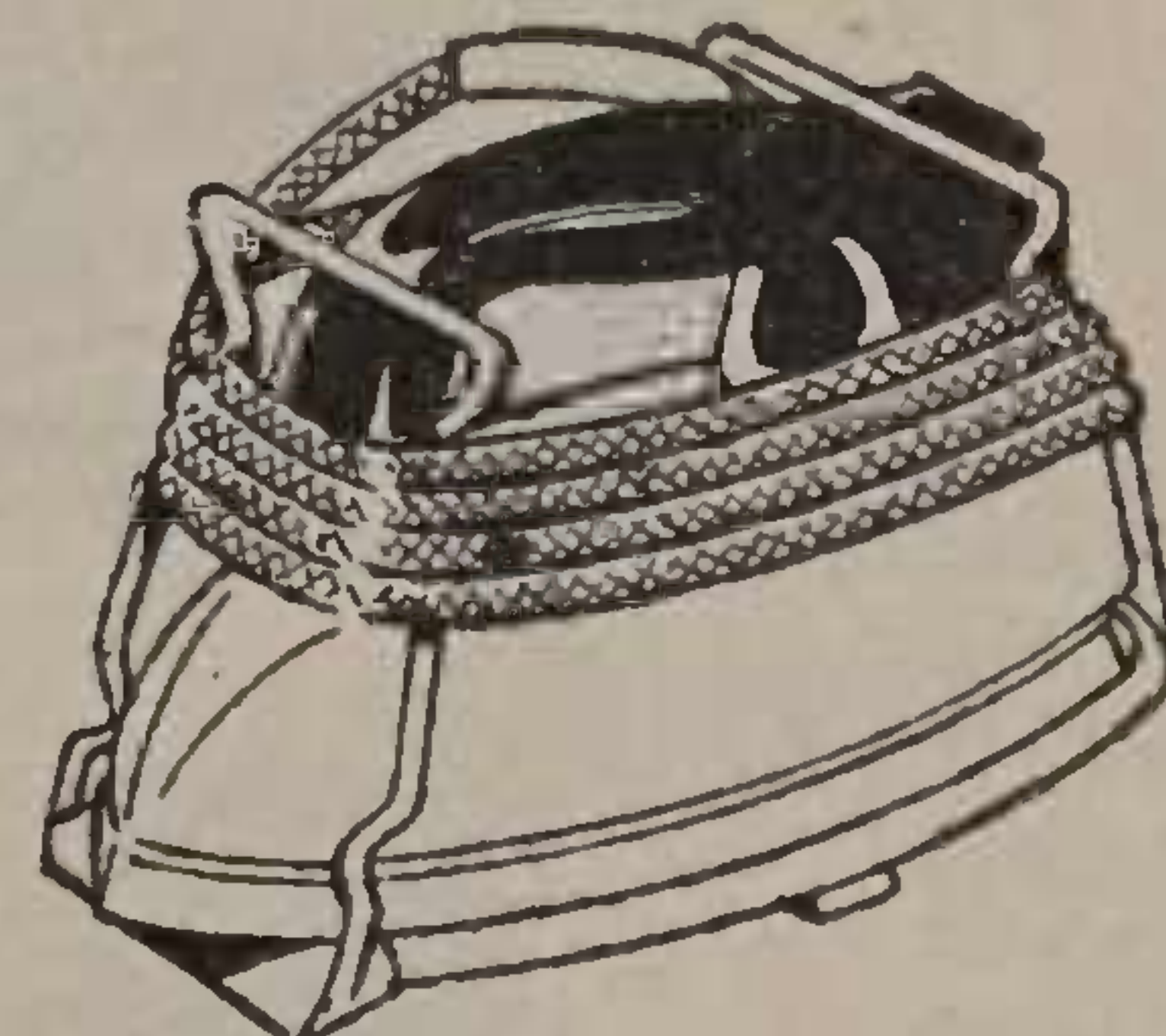


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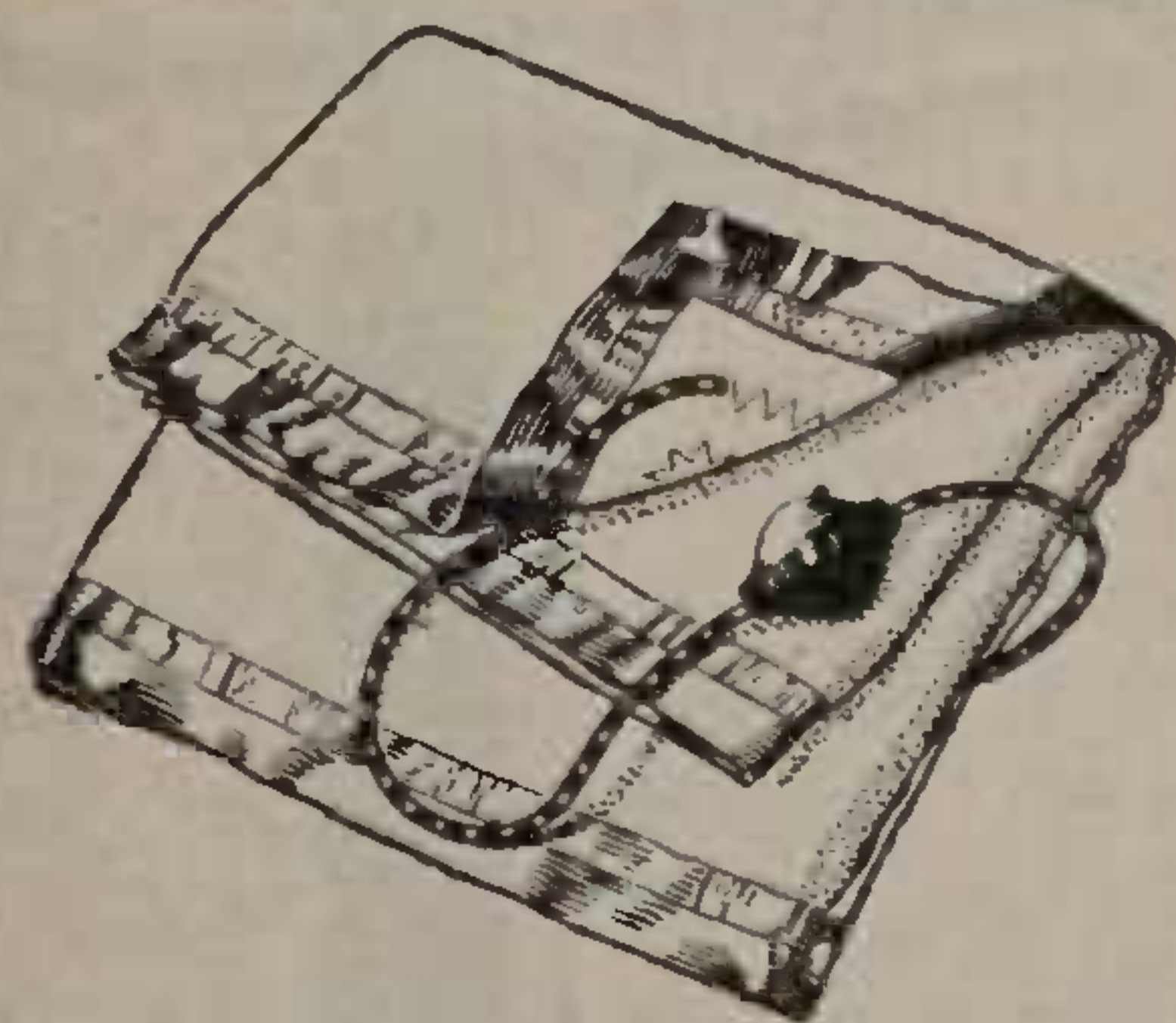
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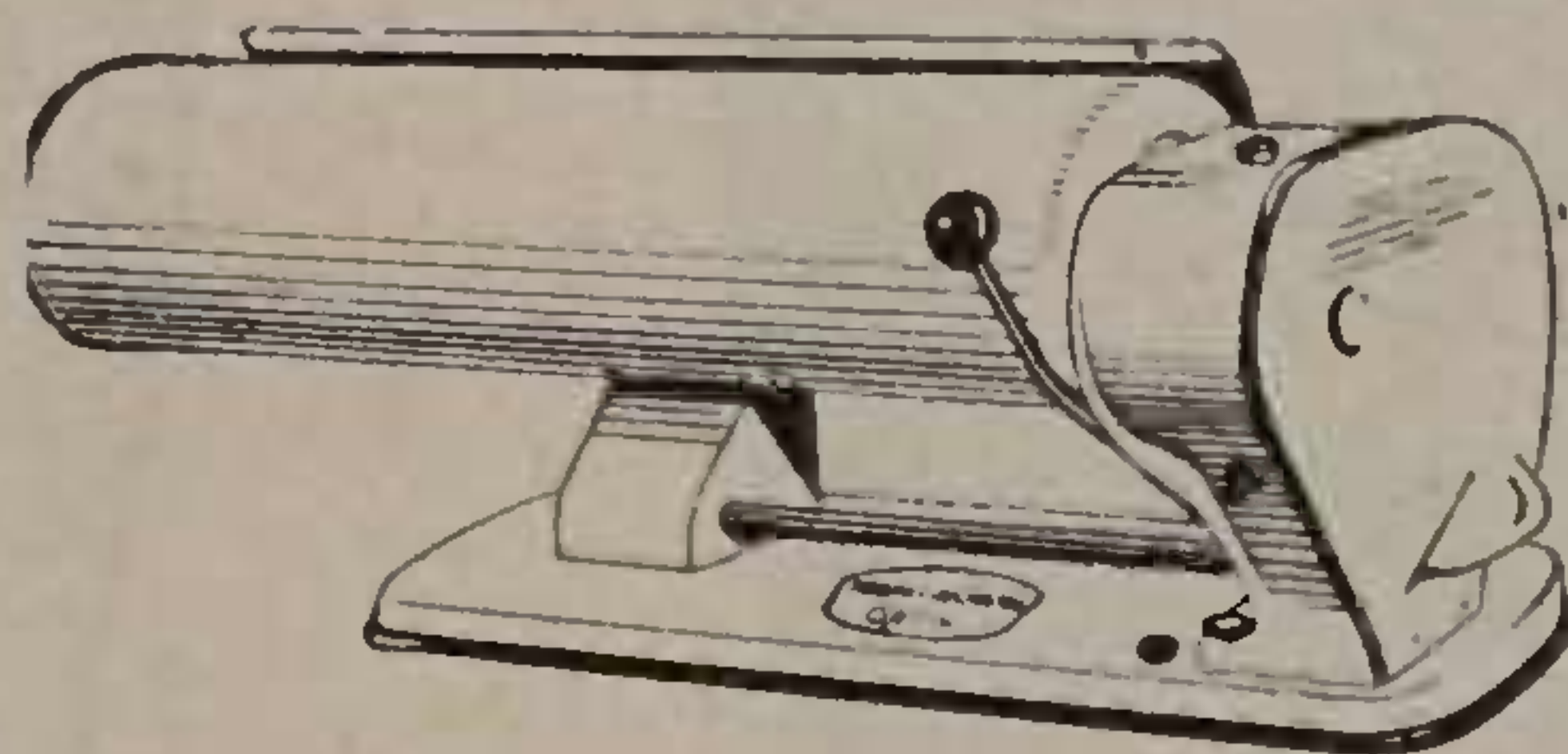
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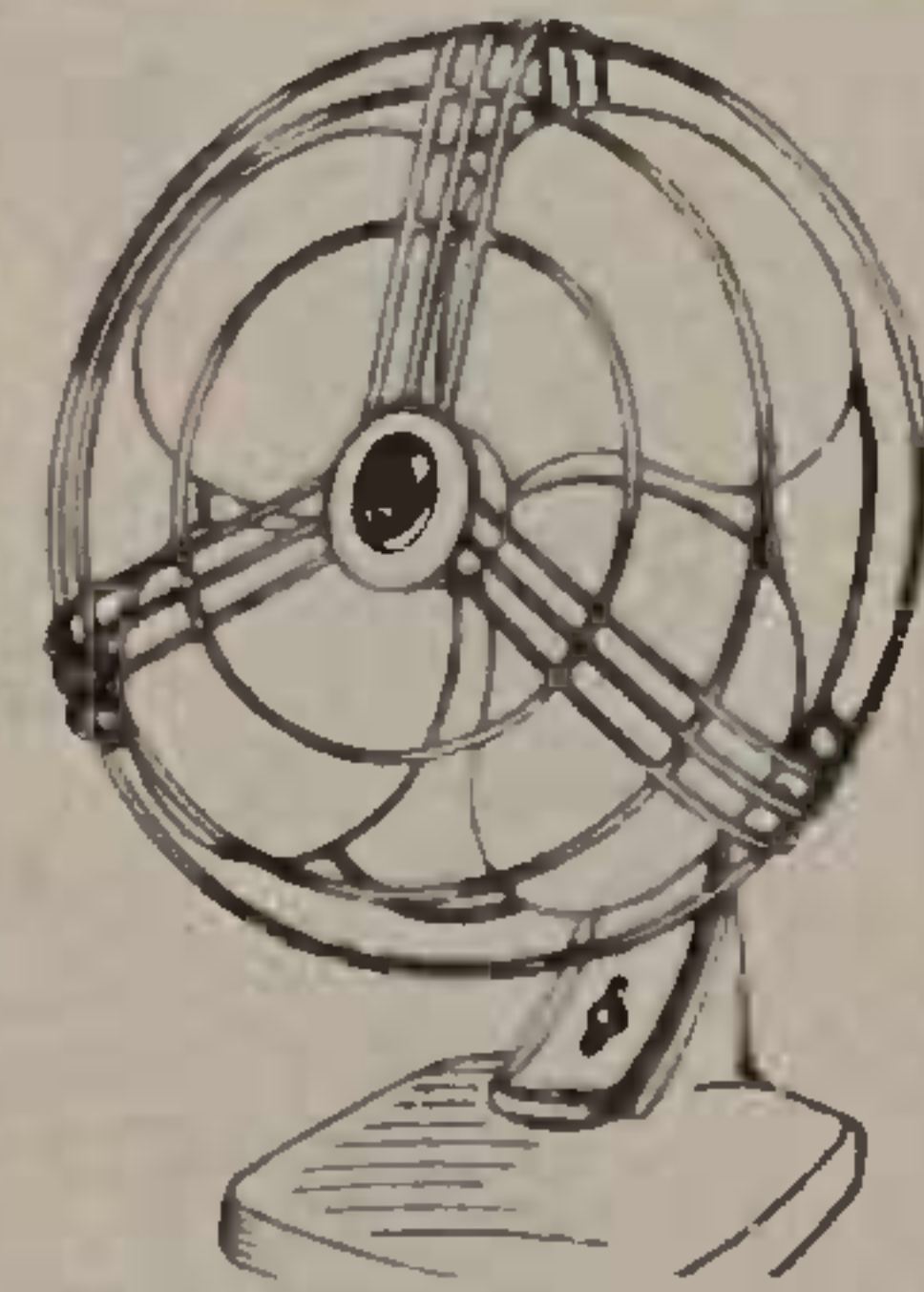
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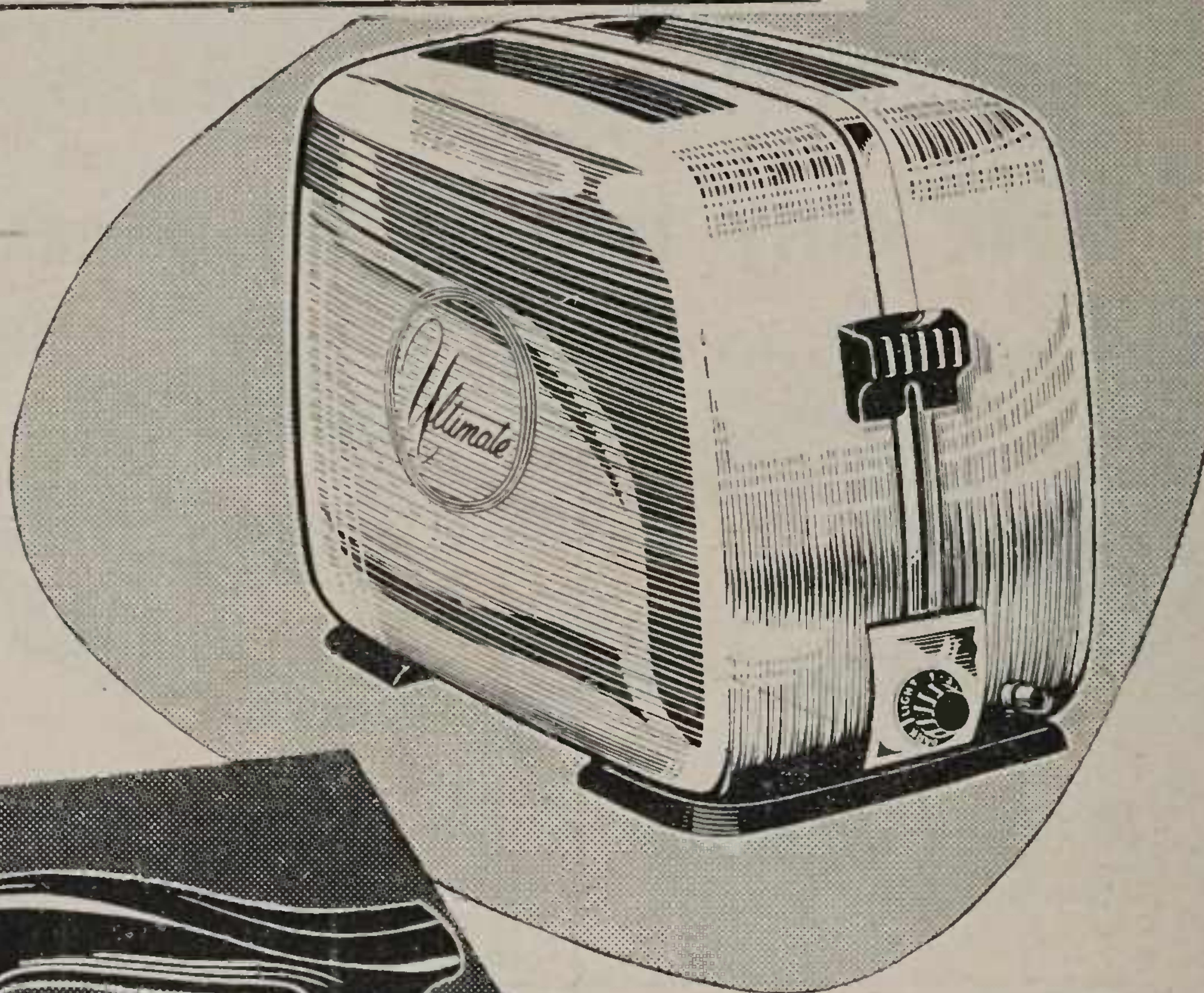


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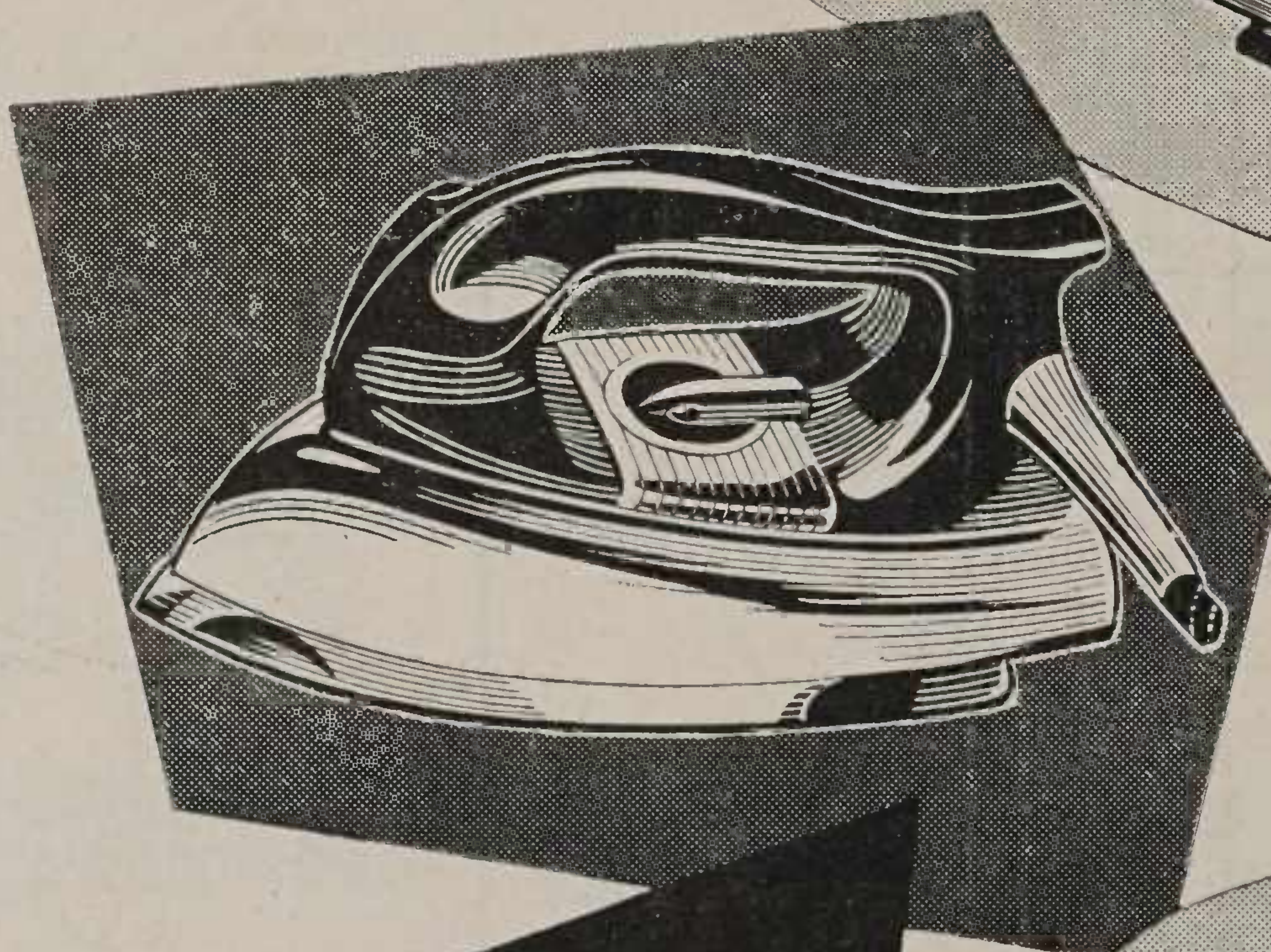
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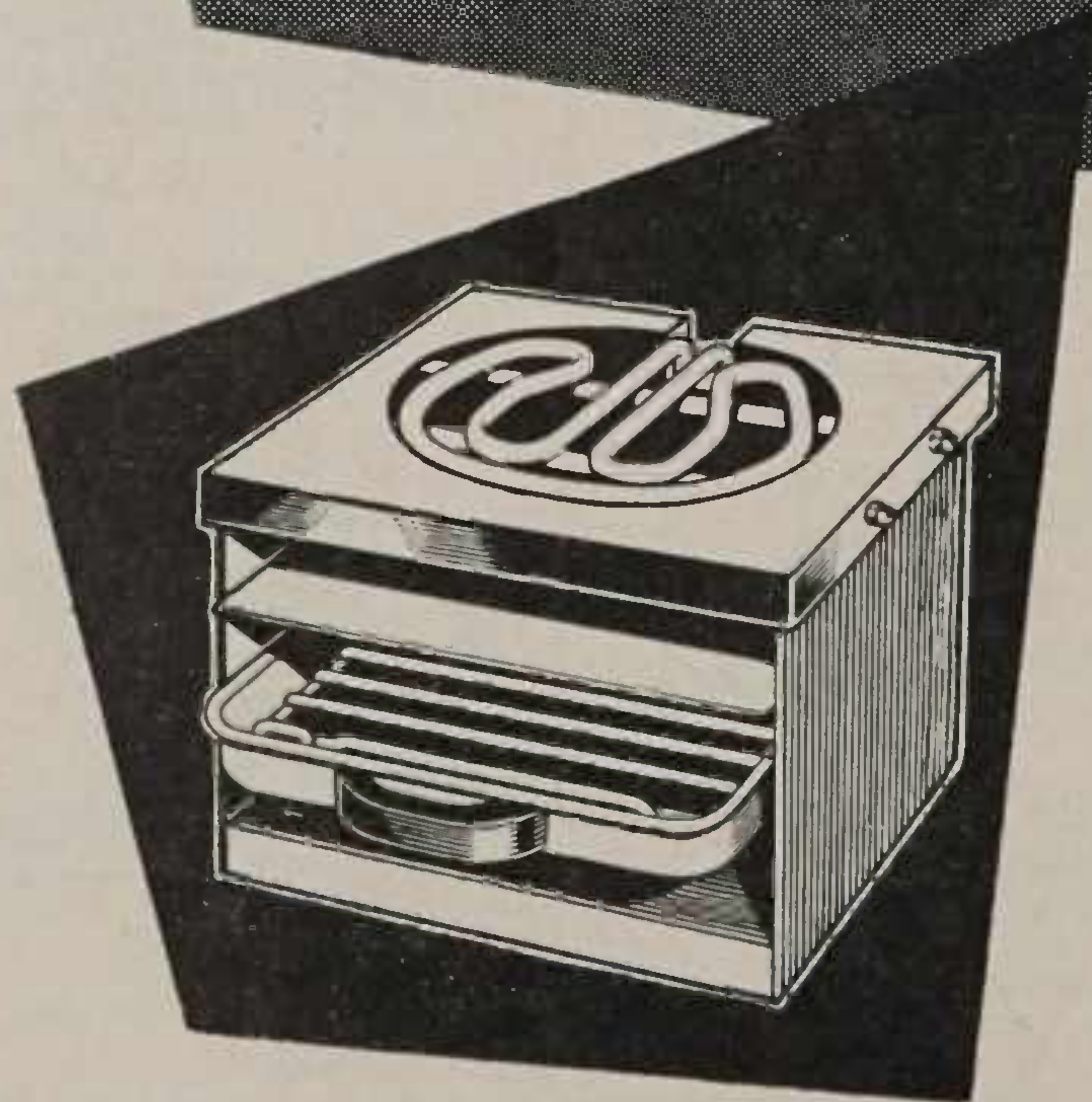


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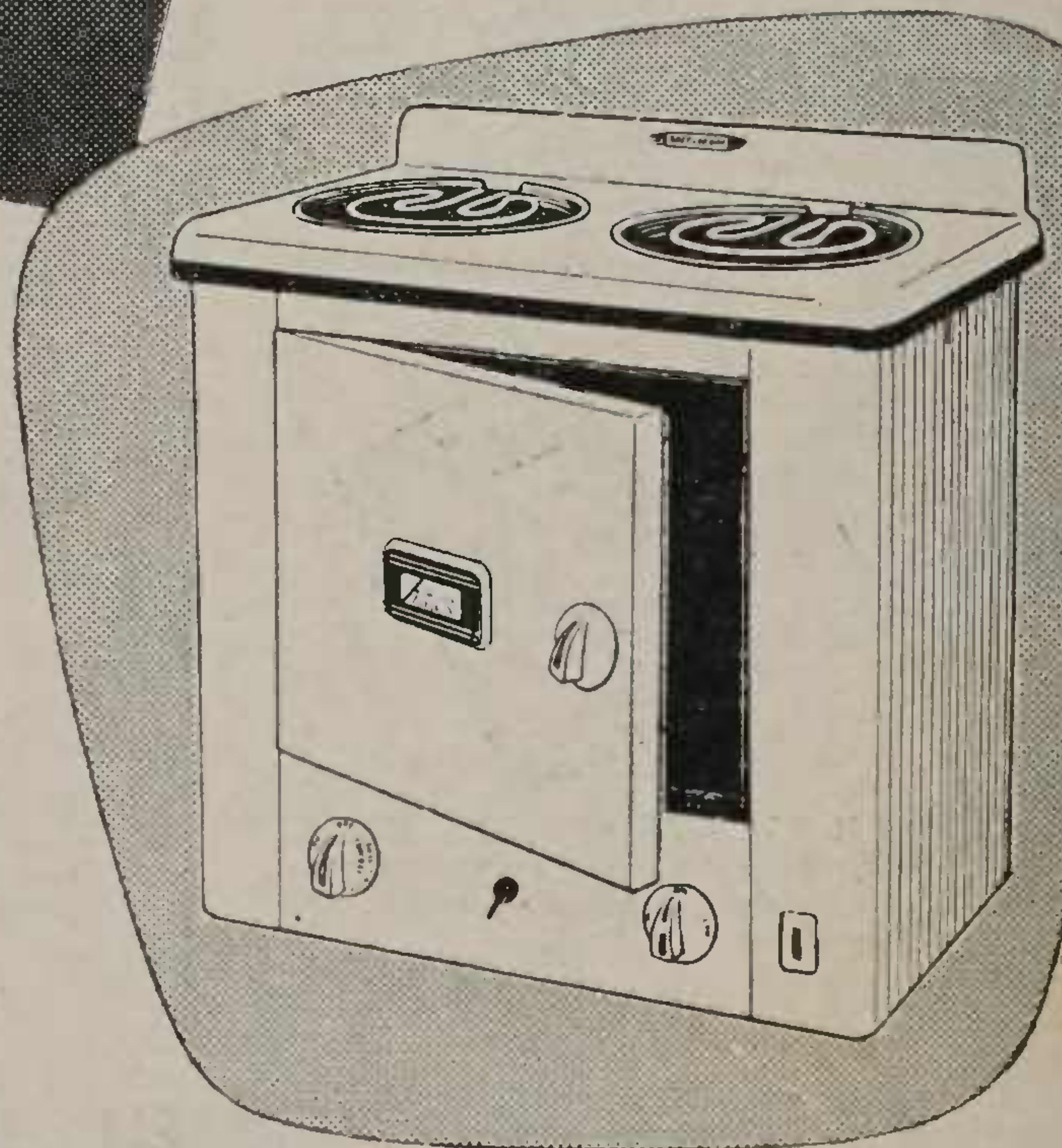


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