

The Rochelle-Salt Crystal Reproducer

July 1932 Radio-Craft

Potassium sodium tartrate ([Rochelle salt](#)) was used in commercial speakers for a while in place of electromagnetic driver coils. The relatively large mechanical deformation produced when subject to an electric field made them attractive as coil alternatives because a separate energization circuit was not required. The drawback, at least early on, was unavailability of crystals large enough to drive anything other than a headphone size speaker cone. This article tells of the time when a process was created to grow large crystals from a seed, similar to how silicon, gallium-arsenide, and other modern semiconductors are grown from seeds. According to author C.B. Scott, it revolutionized the speaker industry - at least for a while. I don't know if a 1930s' lawyer advised companies to place "Do not put in mouth" warning labels on the speakers since, according to Wikipedia, Rochelle salts were also used as laxatives.

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The Rochelle-Salt Crystal Reproducer

By C. B. Scott*

A revolutionary idea in commercial reproducer design. A Rochelle-Salt Crystal, of improved construction, mechanically coupled to a cone gives remarkable clarity and volume. Consuming no power, it has high efficiency.

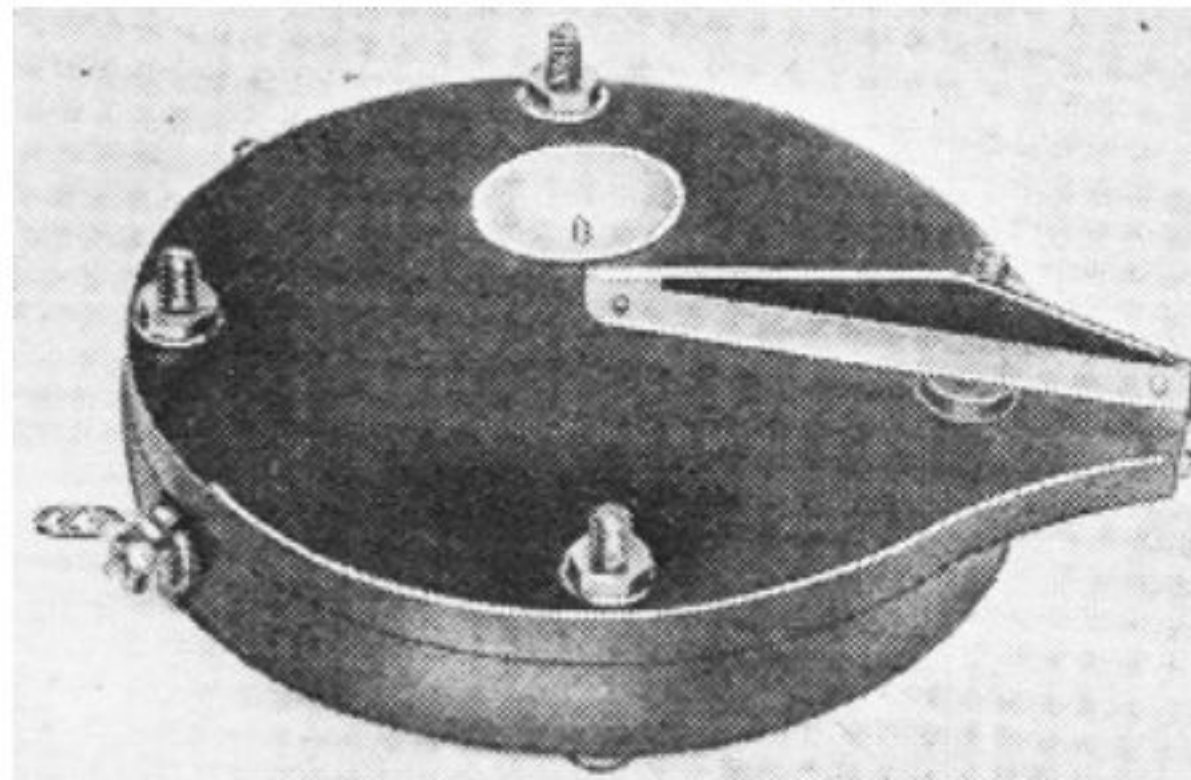


Fig. B - Picture of the new Crystal speaker which is bound to be used in all receivers that require a maximum of sensitivity.

Piezo electricity, a phenomenon well known to most radio engineers, demonstrable in quartz and other crystals, is present in much greater quantity in Rochelle-salt crystals. Until quite recently, however, it had been impossible to obtain these crystals in size and quantity to make their commercial application practicable. At last, a process has been developed for growing large, homogeneous crystals, and methods have been devised for machining and shaping them into usable sizes and shapes.

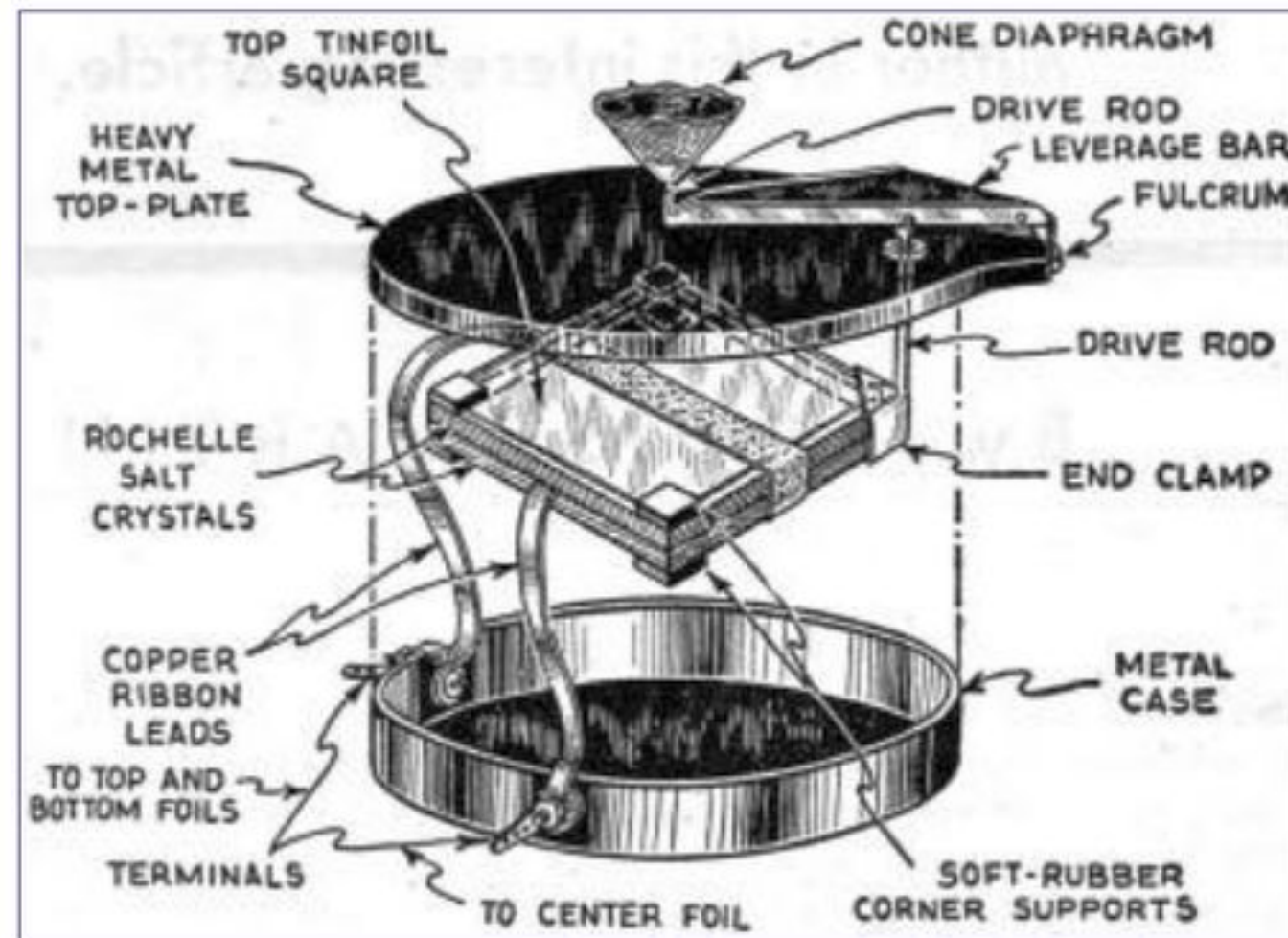


Fig. 1 - The speaker's crystals.

Direction of Motion

The Type R-95 "Crystal Reproducer," illustrated in Figs. A and B uses a double or "bimorph" crystal element consisting of two slabs $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ -in. thick, metal-foiled on each surface, and cemented together in opposition to each other so that a torsional motion of the combined slabs, illustrated in Fig. 1 results; when three corners of the element are held semi-rigid, the vibration of the fourth corner is in a direction vertical to the flat surfaces. (This action is similar to that in thermostats, where the expansion of one metal and contraction of the other in one [parallel] plane, produces a "wiggling" motion in another. Technical Editor.)

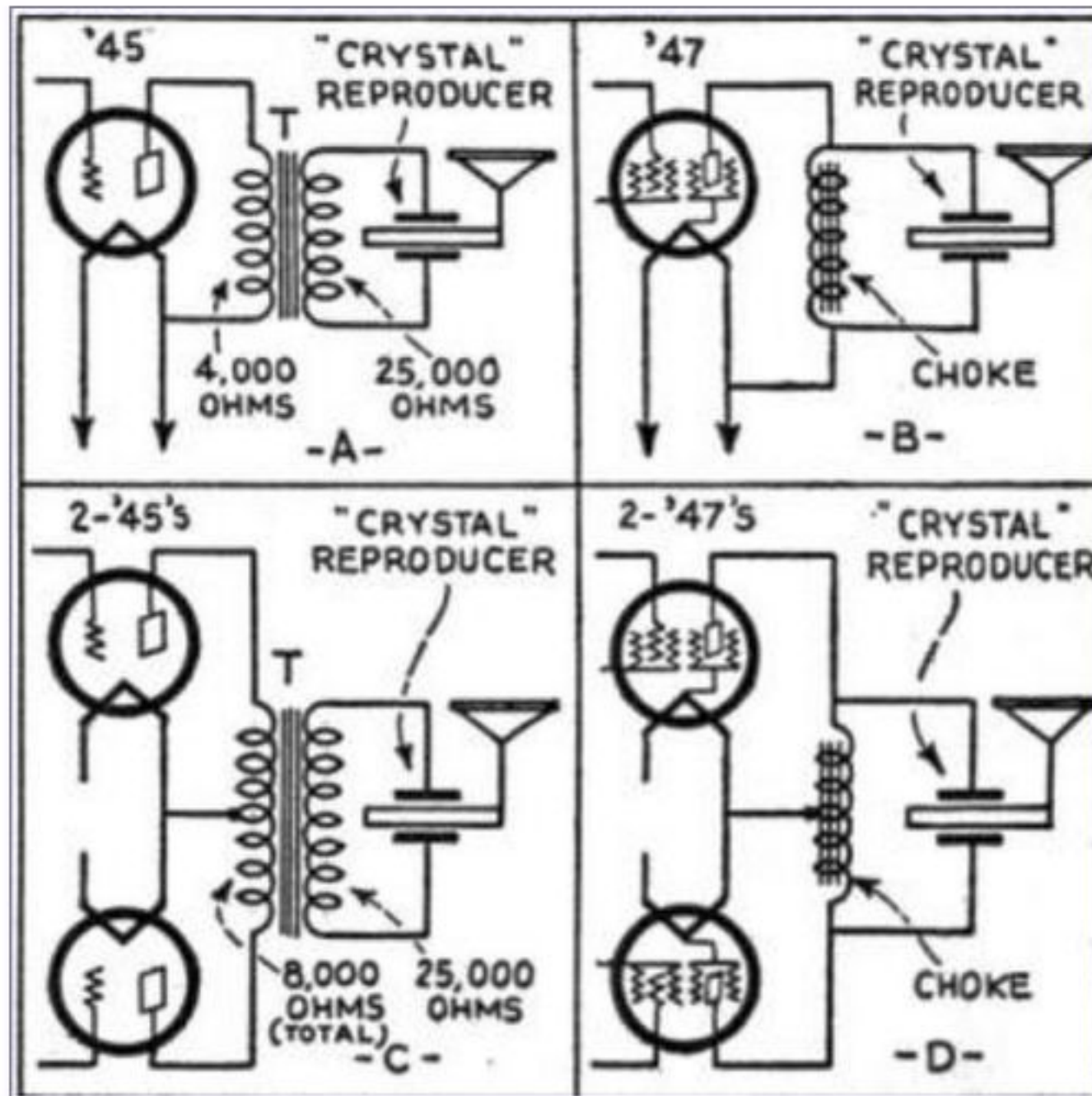


Fig. 2 - Vacuum tube speaker driver circuits

This corner is fitted with a metal cap provided with a connecting link which in turn is soldered to a tone arm, providing a mechanical amplification of motion of 2 1/2 to 1.

The end of the tone-arm is then fastened to the center of a conventional paper cone and results in a very light, compact reproducer, suitable for general use, with an outside diameter of 9 1/2 in., a depth overall of 3 3/4, in.; and a weight of two pounds (as compared with the typical "dynamic" type of reproducer, weighing approximately 5 1/2 pounds).

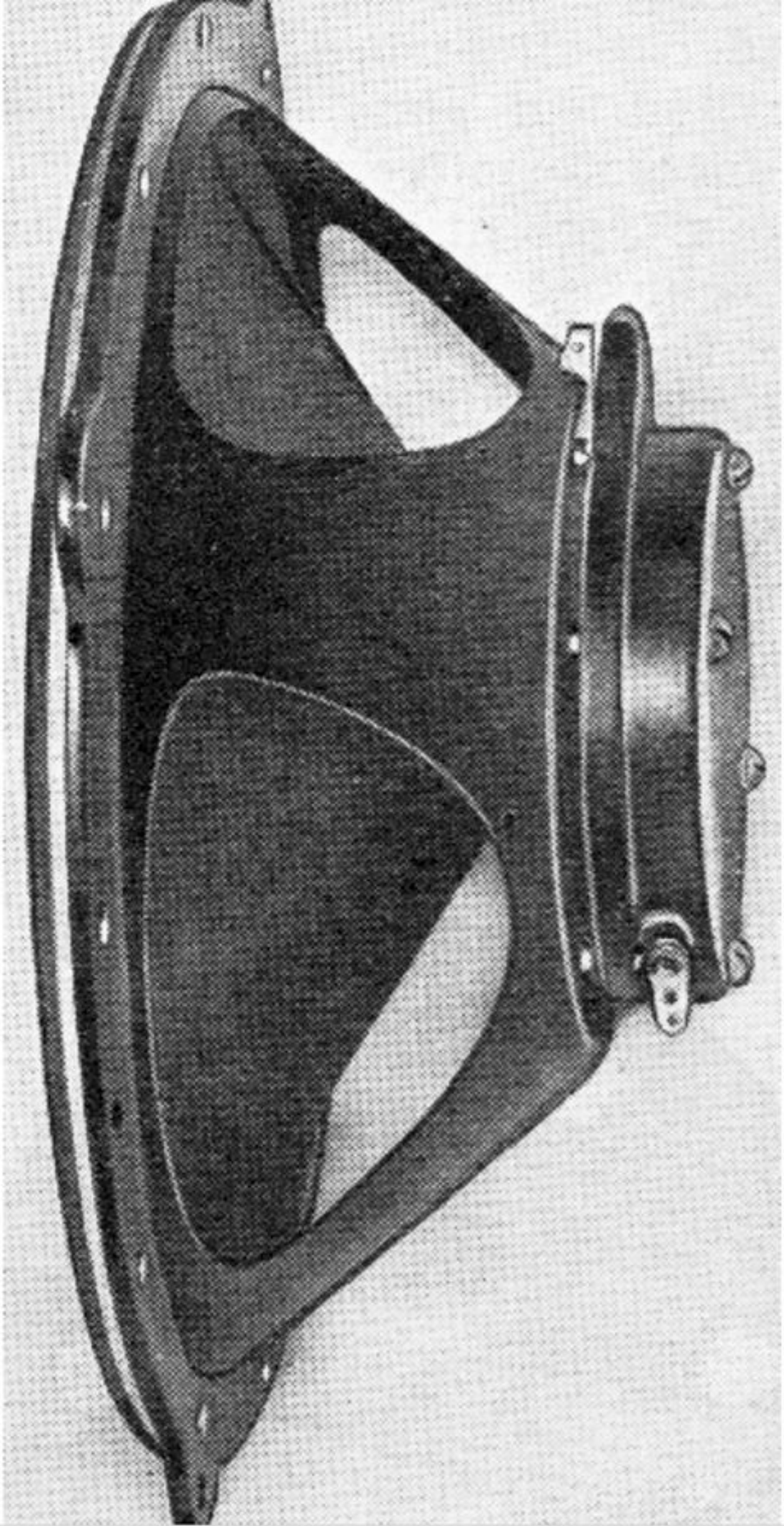


Fig. A - This speaker was tested by Radio Craft and found to have excellent tone quality and volume.

The "crystal" reproducer has several advantages from the electrical point of view.

It is voltage-operated and the power consumption is very low, as it requires neither field current nor polarizing voltage. For this reason it has been recognized as being especially valuable in multiple reproducer work, such as installations in schools, hotels, and hospitals. Due to its very high "sensitivity," several may be operated on the same power required to operate one of the present type of reproducers. Likewise in this type of installation, one of the important factors is that there be a minimum of service and repair work. "Crystal" reproducers have been operated for a continuous period of four years under a wide variation in temperature and humidity change, with no deterioration in output.

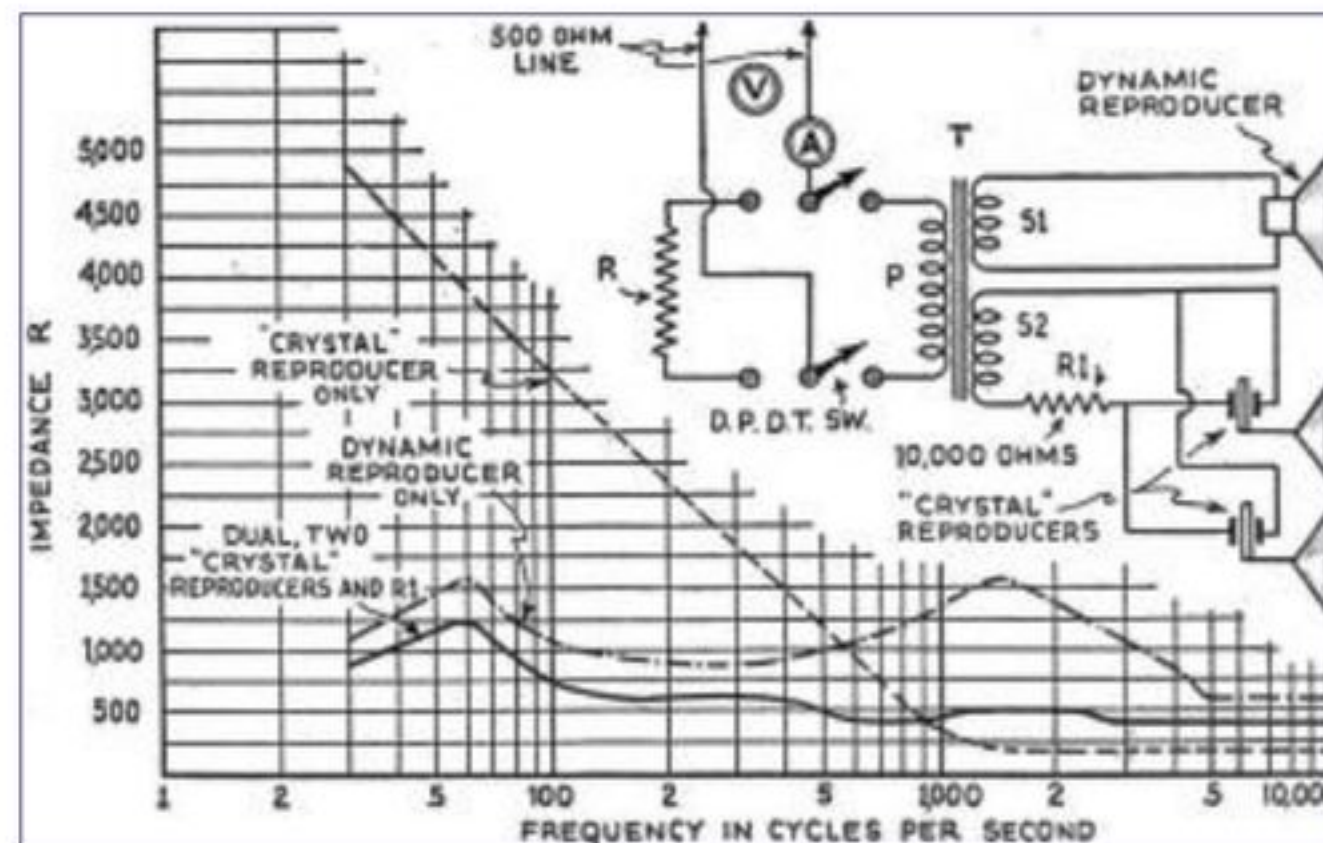


Fig. 3 - Impedance variations.

Frequency Range

The "crystal" reproducer covers a much wider range of frequencies than is now covered by the present types of reproducer units. The Rochelle salt crystal itself is responsive from 0 to 500,000 cycles and when built into a reproducer the only limiting factor is the method by which the crystal is made to reproduce through an associated tone-arm, cone, etc., and the frequencies which are brought to it as a result of broadcast station equipment and radio receiving sets.

The reproducer is considered to have a "negative impedance" (condenser effect) of about 25,000 ohms at 1,000 cycles, and characteristics similar to those of a 0.03-mf. condenser.

It operates extremely satisfactorily when connected directly across an output choke in the plate circuit of a type '47

pentode tube. It also has an astonishing volume when connected across the output inductance in the plate circuit of a pair of type '30 tubes connected in push pull, and is especially good for battery-operated sets when operated by a pair of these tubes in "push-push" or class B amplifier connection. The diagrams shown below indicate the possible hookups with pentode and '45 tubes either singly or in push-pull.

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