

May 23, 1939.

E. G. DANIELSON
TELEPHONE TRANSMITTER

2,159,628

Filed Jan. 20, 1936

2 Sheets-Sheet 1

FIG. 1

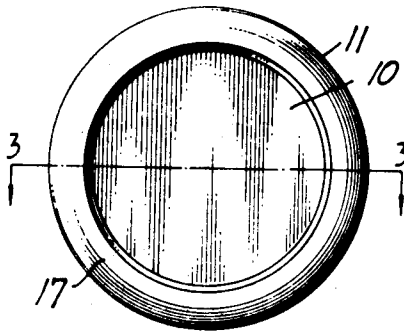


FIG. 2

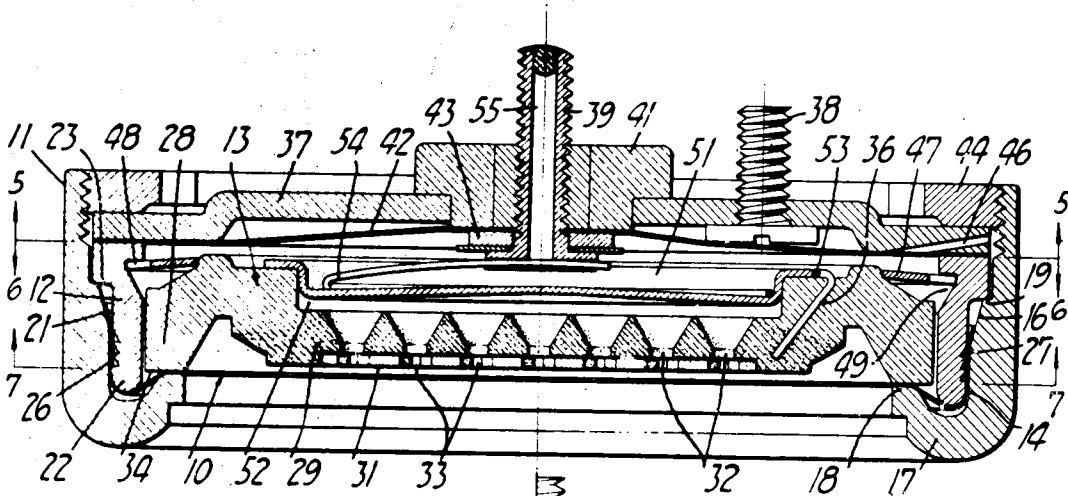
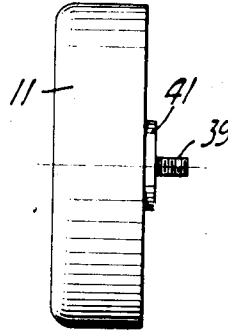
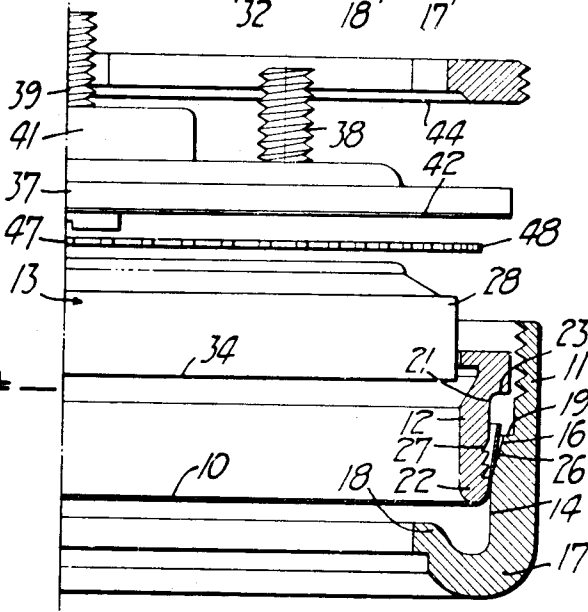


FIG. 3

FIG. 4



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2 Sheets-Sheet 2

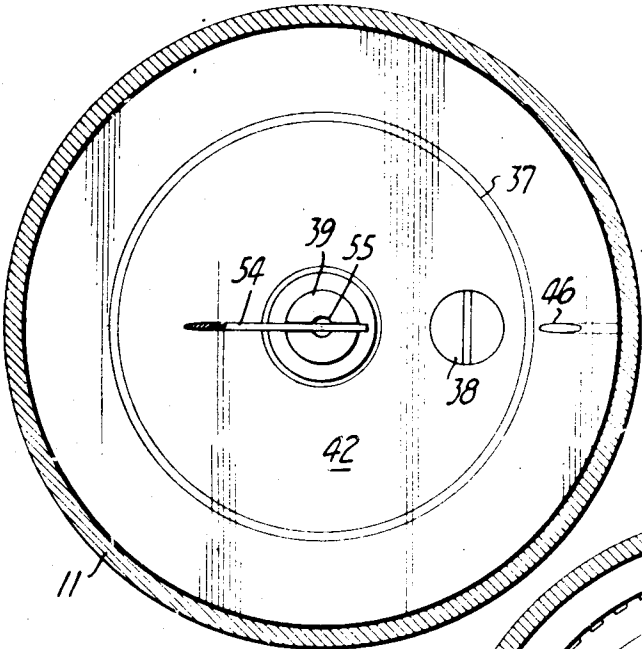


FIG. 5-

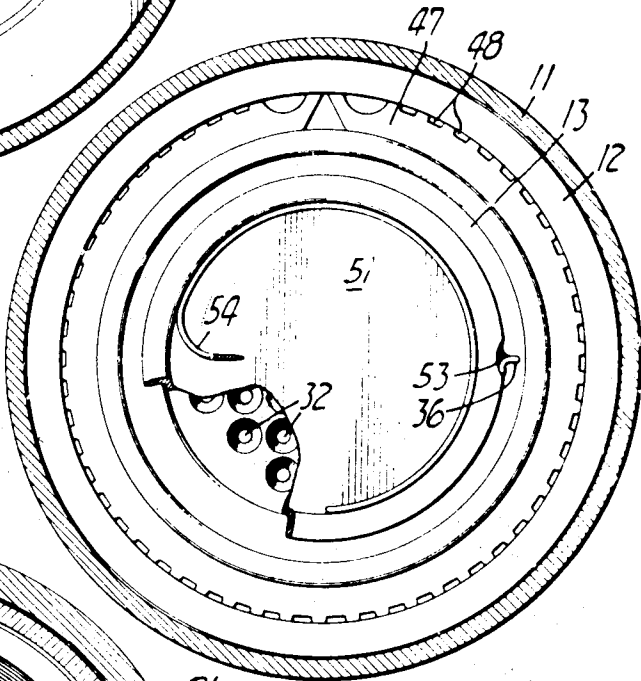


FIG. 6-

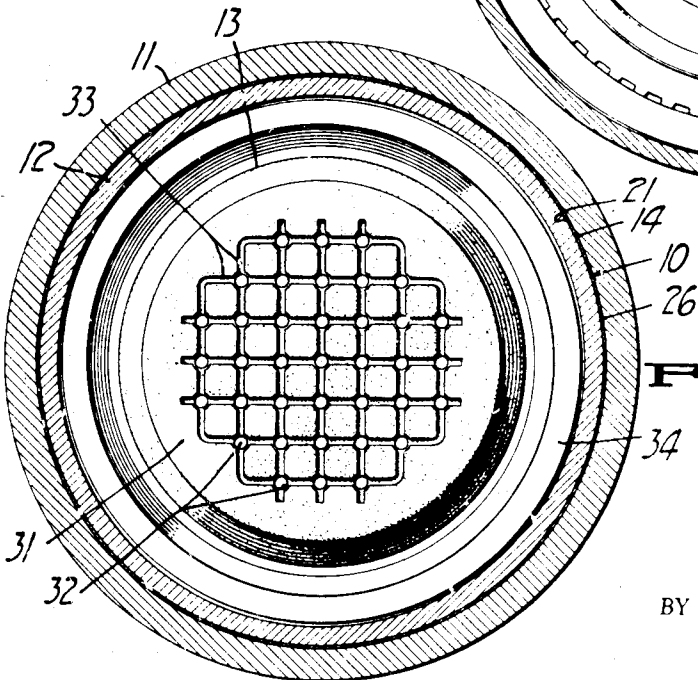


FIG. 7-

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2,159,628

TELEPHONE TRANSMITTER

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Application January 20, 1936, Serial No. 59,877

3 Claims. (Cl. 179-111)

This invention relates generally to the construction of telephone transmitters such as are used in conjunction with radio broadcast equipment and public address systems. More particularly it relates to telephone transmitters of the condenser type in which a thin metal diaphragm or electrode, adapted to be vibrated by sound waves, is in capacitative relationship with an associated rigid electrode or back plate.

It is an object of the invention to generally improve upon the method and means employed for producing and maintaining optimum tensioning of thin metal diaphragms employed in telephone transmitters. In the past, the methods and means employed for this purpose have not been satisfactory, in that it has been difficult if not impossible to uniformly tension the diaphragm in all directions, to a point near the elastic limit of the material. Lack of uniform tension, or lack of tension to the proper degree, is detrimental to fidelity, in addition to the fact that ununiform tension frequently causes mechanical failure. The present invention makes possible uniform tensioning of the diaphragm in all directions, without manufacturing difficulties, and with a predetermined degree of tension which approaches the elastic limit of the material.

A further object of the invention is to improve upon the manufacture and construction of rigid electrodes or back plates, such as are employed in telephone transmitters of the condenser type. In the past, such electrodes have been made of metal, and have required careful and expensive machining operations to produce the desired form. The present invention dispenses with the use of machined metal, and employs a moldable material such as a condensate product, which is molded to substantially final form.

Additional objects of the invention, including the provision of a simplified and novel assembly, will appear from the following description in which the preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawings.

Referring to the drawings:

Fig. 1 is a front elevational view, illustrating a telephone transmitter incorporating the present invention.

Fig. 2 is a side view of the transmitter as illustrated in Fig. 1.

Fig. 3 is a cross-sectional view taken along the line 3-3 of Fig. 1, but on an enlarged scale.

Fig. 4 is an "exploded" view on the same scale

as Fig. 3, and showing certain parts in cross section.

Fig. 5 is a cross sectional detail taken along the line 5-5 of Fig. 3, but on a smaller scale.

Fig. 6 is a cross sectional detail taken along the line 6-6 of Fig. 3, and on the same scale as Fig. 5.

Fig. 7 is a cross sectional view taken along the line 7-7 of Fig. 3, and on the same scale as Figs. 5 and 6.

The transmitter illustrated in the drawings consists of a thin metal diaphragm 10, which is tensioned across one face of a shell 11. An inner annular member or ring 12 cooperates with the shell 11 in a manner to be presently explained, to maintain the diaphragm 10 properly tensioned. In a transmitter of the condenser type diaphragm 10 forms a vibratory electrode, responsive to sound waves, while a button-like structure 13 immediately behind the diaphragm 10, serves as a rigid electrode or back plate. With respect to the materials utilized, it is desirable to form the diaphragm 10 of a strong light alloy like duralumin having a thickness in the order of one thousandth of an inch. A similar alloy is suitable for forming the shell 11, and the inner ring 12.

The preferred manner in which the shell 11 and ring 12 are adapted to tension the diaphragm 10 during assembly, and to maintain tension to the desired degree, can be described as follows:— Shell 11 is formed to provide a substantially cylindrical inner surface 14, which is a continuation of the annular bevelled surface 16. The forward face of the shell is provided with an inturned portion 17, to form an annular shoulder 18 which the diaphragm 10 engages. To the rear of the bevelled surface 16 the shell is formed to provide an annular abutment or shoulder 19, which forms a stop for limiting movement of the ring 12 in one direction.

Ring 12 is provided with a cylindrical surface 21, which is dimensioned to fit tightly within the cylindrical surface 14. The forward end edge of ring 12 is rounded as indicated at 22, while the rear portion is enlarged to afford a shoulder 23, for engaging the shoulder 19 of the shell.

The thin sheet metal of which the diaphragm is constructed is initially cut to a diameter substantially larger than the diameter of the cylindrical surface 14. This circular blank is then placed upon the rear face of the shell 11, with its center concentric with the axis of the shell. By means of a suitable assembling machine, ring 12 is then advanced upon the diaphragm, with the result that as the ring enters the shell, the

edge portion of the diaphragm is bent rearwardly. As the ring commences to telescope with the cylindrical surface 14 of the shell, the peripheral edge portion of the diaphragm is tightly gripped, as illustrated in Fig. 4. Additional advancing movement of the ring 12 accomplishes substantially a drawing operation upon the peripheral edge portion of the diaphragm, with the result that the margin of the diaphragm is drawn to substantially cylindrical form. The drawing operation causes a certain amount of tightening of the diaphragm, but it is not tensioned to a degree desired in the final assembly. As the ring 12 is advanced to its final assembled position illustrated in Fig. 3, the diaphragm contacts the annular shoulder 18, and thereafter a lateral distortion of the diaphragm occurs, without slippage of the marginal portion of the diaphragm with respect to the ring 12. When shoulders 19 and 23 come into engagement, the diaphragm has been tensioned to the degree desired, to a point near the elastic limit of the material.

In Fig. 3 the drawn marginal edge of the diaphragm has been designated by numeral 26, and is relatively free of folds such as might cause uneven gripping. During the assembly operation just described it is desirable to heat the shell 11 to an elevated temperature, so that it will subsequently shrink and more effectively grip the margin of the diaphragm. Likewise in order to safeguard against slippage of the margin of the diaphragm with respect to ring 12, during the final tensioning of the diaphragm, the ring can be provided with a series of annular grooves 27.

The button-like structure 13 is annular in contour, and of such a diameter as to fit loosely within the ring 12. It is formed as an integral body of suitable molded material, such as a phenolic or urea condensate. The outer peripheral portion 28 is electrically non-conductive, while the inner portion 29 is provided with an electrically conductive planar surface 31. Surface 31 is in relatively close parallel relationship with the adjacent side of diaphragm 10, as for example a clearance on the order of one thousandth of an inch. In this connection note that the clearance as illustrated in Fig. 3 has been exaggerated, for purposes of clarity.

In order to provide proper acoustical characteristics the portion 29 is provided with a series of openings 32, a suitable arrangement of which is illustrated in Fig. 7. The conductive face 31 is also interrupted by a series of grooves or channels 33, which communicate with the openings 32. Such an arrangement of openings and channels permits escapement of gas from the relatively thin di-electric film interposed between the diaphragm and the conductive face 31. The forward annular face 34 of the peripheral portion 28, is in engagement with the rear face of the diaphragm 10, and therefore serves to maintain the desired clearance between the conductive face 31, and the diaphragm.

In forming the button-like structure 13 as described above, it is molded to substantially final form. In other words the openings 32, as well as the channels 31, are provided by virtue of the character of the molds or dies employed, instead of being machined into the body after the molding operation. The conductive surface 31 can be formed by any one of a number of different methods. The preferred method is to form the intermediate portion 29 of the body, of a homogeneous mixture of condensate material and

electrically conductive particles, as for example carbon or graphite. This can be readily done by making up two pellets for the molding operation, one being a disc-like pellet containing condensate material mixed with a divided conductive material like carbon or graphite, and the other being an annular ring-like pellet formed only of condensate material, with possibly a non-conductive filler medium. For the molding operation these pellets are placed concentrically within the forming die, and upon being compressed in conjunction with heat, the material of the two pellets fuses together to form an integral final body. After the molding operation, it is only necessary to machine off and polish the surface 31, so that the desired clearance will be afforded with respect to the diaphragm 10. As an alternative procedure the body can be molded to substantially complete form, using ordinary condensate materials, and the surface 31 then covered with a thin sheet of metal or like conductive material, by electro-plating or by a sputtering process. This conductive surface can then be machined and polished, to afford the desired degree of accuracy.

Assuming that the preferred procedure is employed for making the button-like structure 13, a lead wire 36 can be embedded in the conductive portion 29, and is shown extending to the rear side for convenient electrical connection.

For completing the assembly, a closure disc 37 is shown extending over the rear side of the shell 11. This closure plate carries the terminal screws 38 and 39, with the terminal 39 being insulated by bushing 41. Extending adjacent the inner face of the closure plate 37, there is a flexible diaphragm 42, formed of suitable material such as an impervious di-electric cloth. The peripheral margin of diaphragm 42 is shown interposed between the rear end face of ring 12 and the adjacent marginal face of the closure plate 37. It is also shown apertured centrally to accommodate screw 39, with the annular portion immediately surrounding such opening gripped between the inner face of bushing 41, and a washer 43. The plate 37 is clamped to its desired position, by suitable means such as an annular threaded ring 44. The space between the inner face of plate 37, and the diaphragm 42, is exposed to atmospheric pressure, through duct 46.

The button-shaped structure 13, is retained in proper assembled relationship, with respect to the diaphragm 10 and ring 12, by suitable means such as an annular spring clip 47. The notched periphery 48 of this clip is adapted to engage within a groove 49, formed in ring 12, while the inner periphery engages the adjacent rear face of the button-like structure 13, to urge this structure towards the diaphragm 10.

In order to minimize distortion due to cavity resonance, a device 51 is employed, which can be termed an acoustical valve. This device can be made of pressed sheet metal, in the form of a shallow cup, which is seated within the annular recess 52, formed on the rear side of the structure 13.

Electrical connection between the terminal 39 and the lead wire 36, can be made by any suitable expedient. For example lead wire 36 can be electrically connected to the device 51, as indicated at 53, and connection between this device and the inner end of terminal 39, can be established by the bowed spring wire 54.

In assembling the entire transmitter it is desirable to expel atmospheric air and provide an

atmosphere of suitable inert gas, such as nitrogen. This can be done by introducing nitrogen gas through the opening 55, through terminal 39, before final tightening of the threaded ring 44. After this operation opening 55 is sealed, and thereafter flexing of diaphragm 42 equalizes the pressure within the transmitter, with the pressure of the external atmosphere.

The simplicity of the completed assembly will be apparent from the above description. The arrangement utilized for tensioning the diaphragm 10 dispenses with the use of conventional bolts and like clamping devices, and makes possible a more compact structure, having superior acoustical characteristics because of the absence of cavity resonance. Although the diaphragm is tensioned to a relatively high degree, the fact that the tension is adequately distributed in all directions minimizes breakage, both during manufacture and assembly, and during usage. Use of the molded button-like structure 13 greatly simplifies manufacturing problems, because the openings 32 and particularly the channels 33, need not be formed by accurate machining methods, such as have been used in the past.

I claim:

1. In a telephone transmitter of the condenser type wherein a vibratable electrode is disposed in close spaced relationship with one face of a stationary electrode, a relatively flat rigid body formed integrally of molded condensate material, a portion of the body intermediate its peripheral edge portion being formed of a homogeneous mixture of condensate material and divided conduc-

tive particles, whereby said intermediate portion is rendered electrically conductive to serve as said stationary electrode, the peripheral edge portion of the body being non-conductive.

2. In a telephone transmitter of the condenser type wherein a vibratable electrode is disposed in close spaced relationship with one face of a stationary electrode, a relatively flat rigid body formed integrally of molded condensate material, a portion of the body intermediate its peripheral edge portion being formed of a homogeneous mixture of condensate material and electrically conductive particles, whereby said intermediate portion is electrically conductive to serve as said stationary electrode, said intermediate portion also having openings therein and having one side face for cooperation with said vibratable electrode, the peripheral edge portion of the body being non-conductive.

3. An electrode for a telephone transmitter of the condenser type, comprising a relatively flat rigid body formed integrally of molded condensate material, a portion of the body intermediate its peripheral edge portion comprising a homogeneous mixture of condensate material and electrically conductive particles, whereby said intermediate portion is rendered electrically conductive, said intermediate portion having openings therein and having one planar side face, said side face being interrupted by grooves which communicate with said openings, the peripheral edge portion of the body being electrically non-conductive.

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