

May 20, 1930.

P. E. EDELMAN

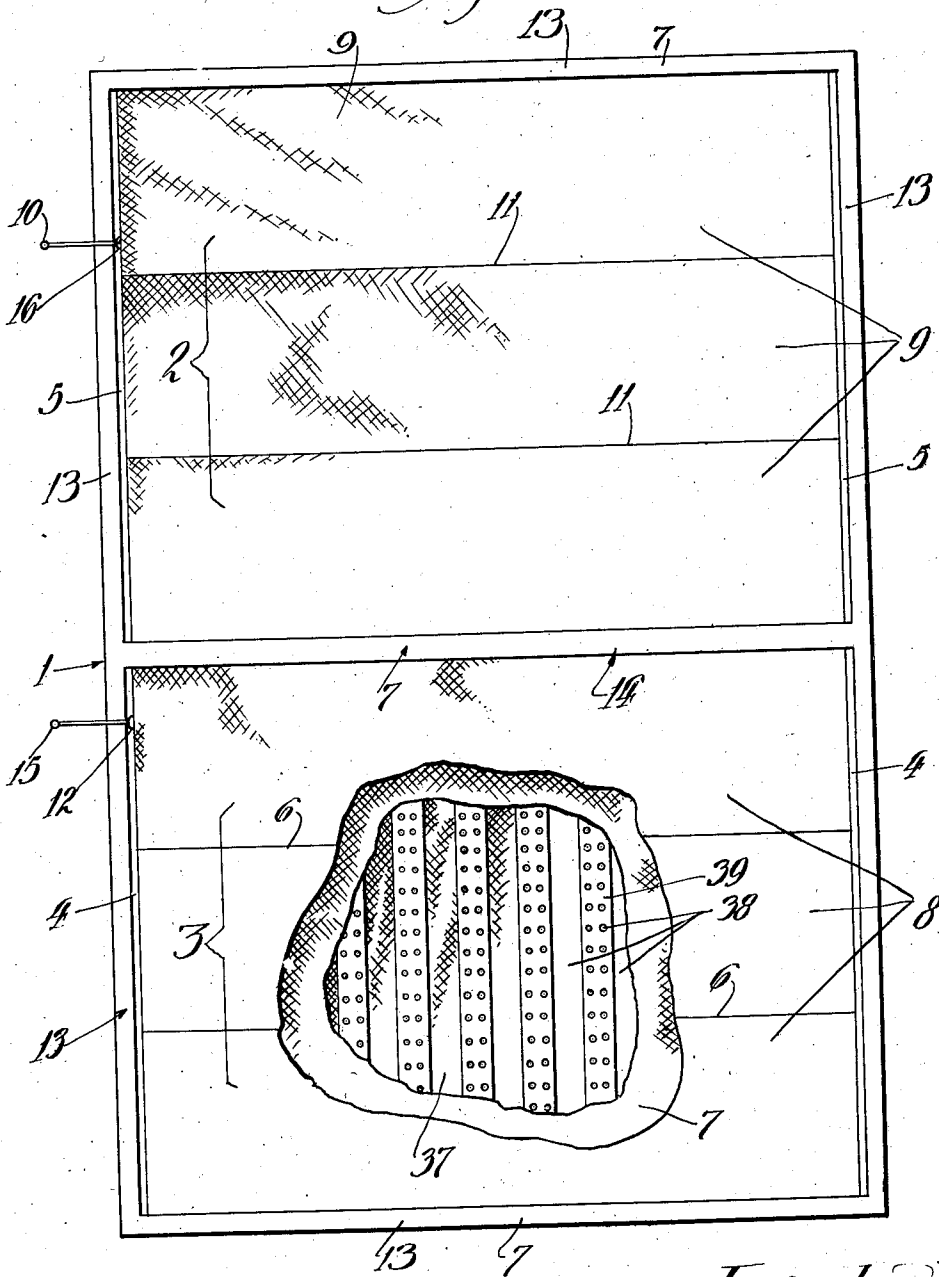
1,759,811

PUSH-PULL CONDENSER SPEAKER

Filed April 17, 1929

4 Sheets-Sheet 1

Fig. 1.



Inventor:
Philip E. Edelman,
By: Banning & Banning
Attorneys

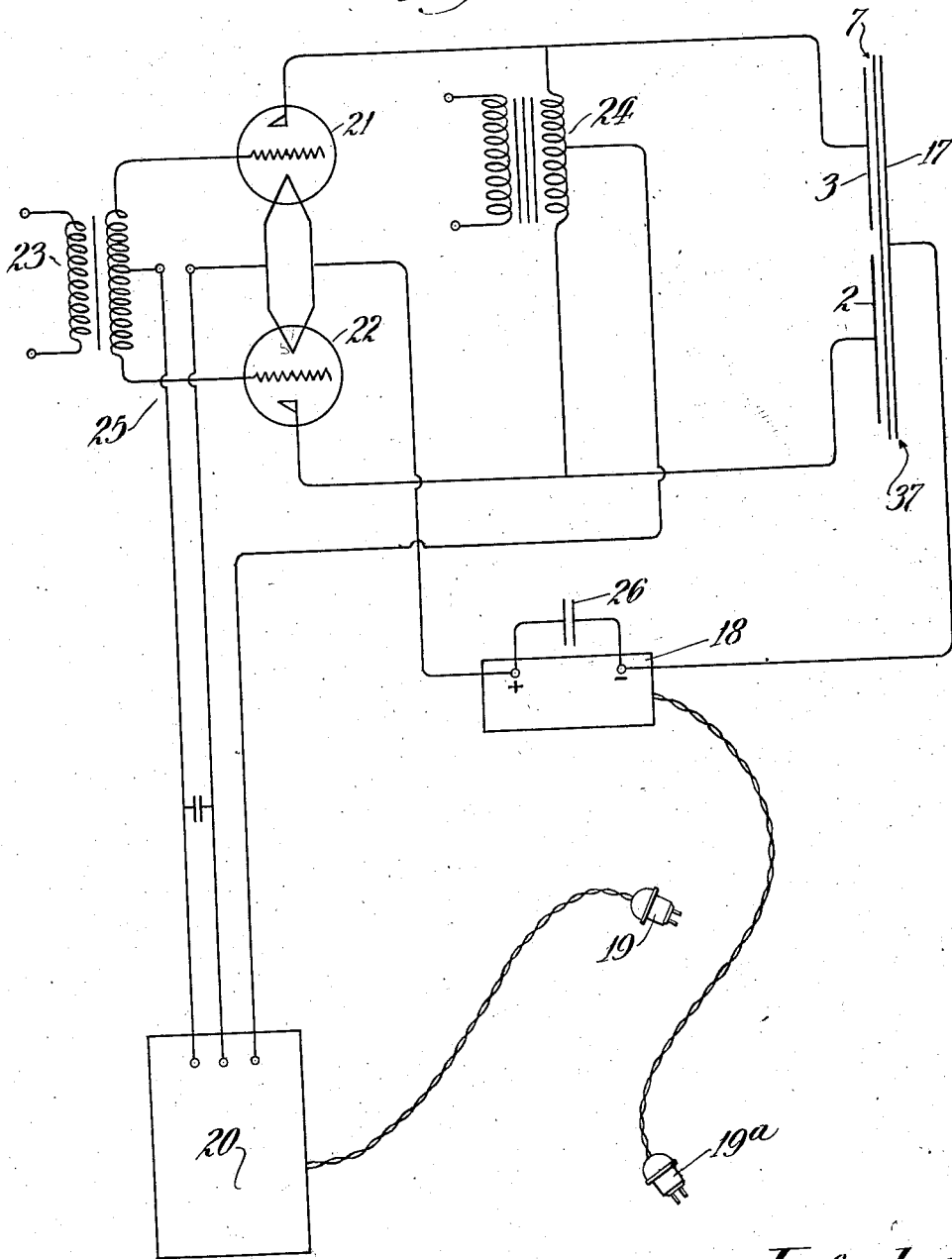
May 20, 1930.

P. E. EDELMAN
PUSH-PULL CONDENSER SPEAKER
Filed April 17, 1929

1,759,811

4 Sheets-Sheet 2

Fig. 2.



Inventor:
Philip E. Edelman,
By, Banning & Banning
Attorneys.

May 20, 1930.

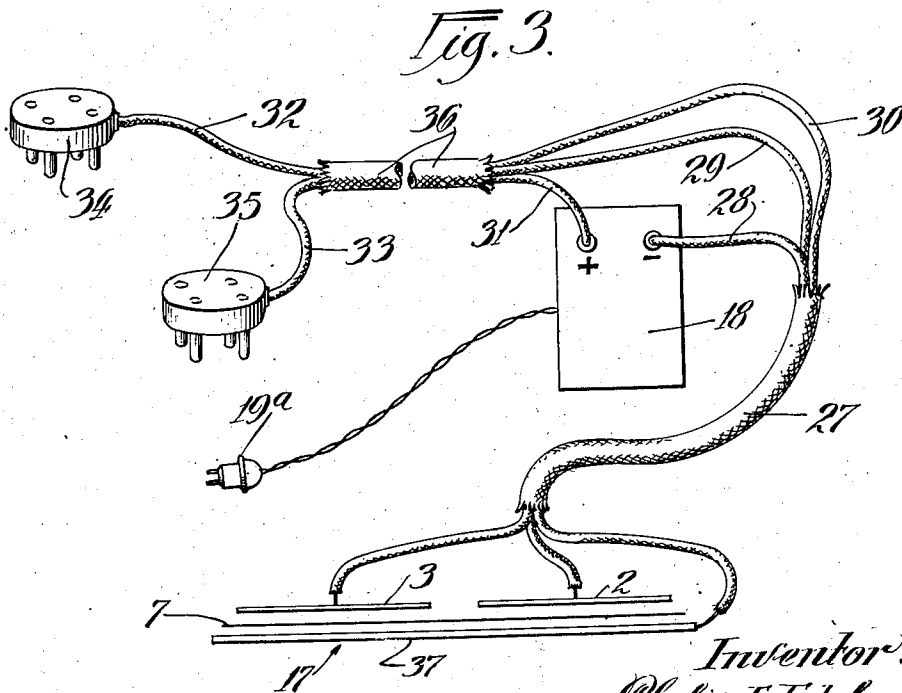
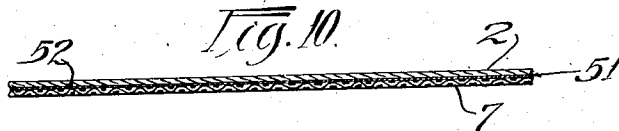
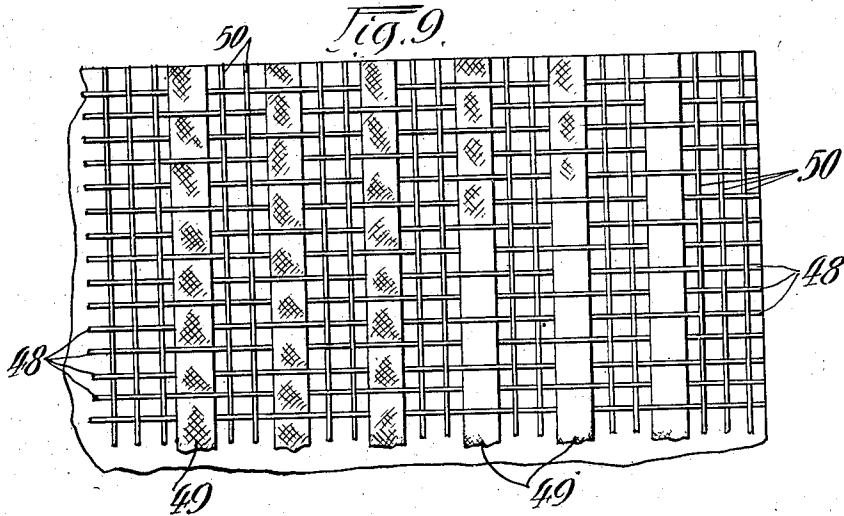
P. E. EDELMAN

1,759,811

PUSH-PULL CONDENSER SPEAKER

Filed April 17, 1929

4 Sheets-Sheet 3



Inventor:
Philip F. Edelman,
By *Banning & Banning*
Attorneys.

May 20, 1930.

P. E. EDELMAN

1,759,811

PUSH-PULL CONDENSER SPEAKER

Filed April 17, 1929

4 Sheets-Sheet 4

Fig. 4.

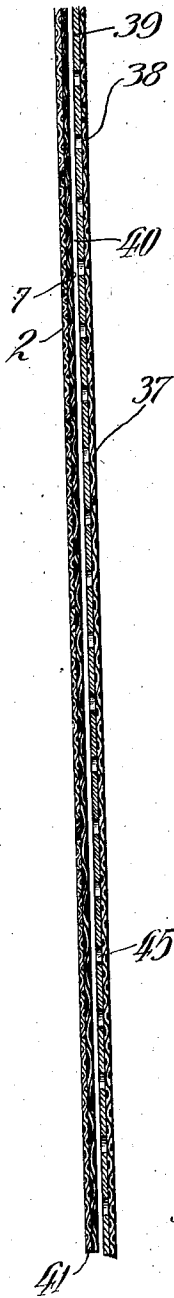


Fig. 6.

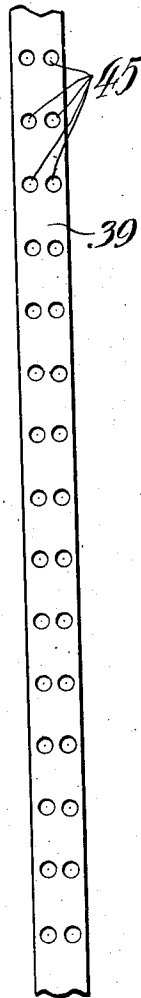


Fig. 8.

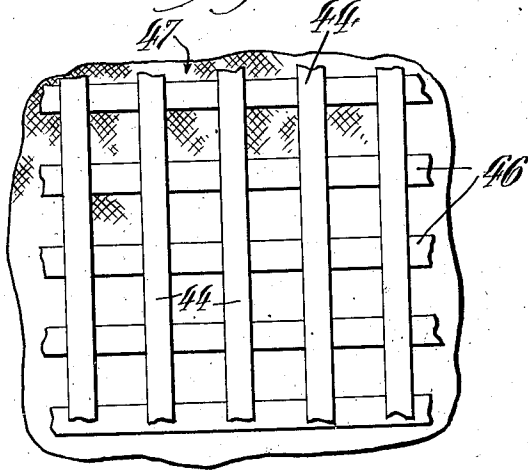


Fig. 5.

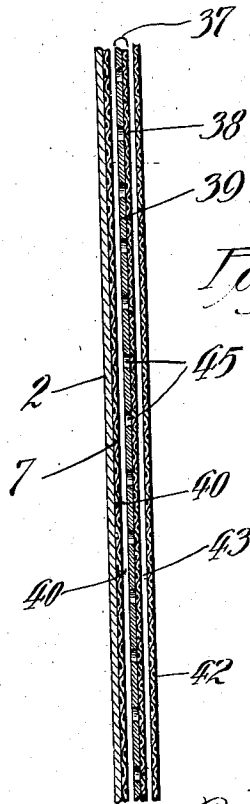


Fig. 7.



Inventor:
Philip F. Edelman,
By, *Banning & Banning*
Attorneys.

UNITED STATES PATENT OFFICE

PHILIP E. EDELMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO EPHRAIM BANNING, OF CHICAGO, ILLINOIS

PUSH-PULL CONDENSER SPEAKER

Application filed April 17, 1929. Serial No. 355,957.

My present invention relates to improvements in acoustic condenser speakers, and is more particularly for a push-pull condenser reproducer, though it may also be used on the output of a single vacuum tube amplifier.

An object of this invention is to provide an improved acoustic condenser and a method of making the same.

Another object is to provide improved structure and circuit connections to operate a condenser type reproducer from a vacuum tube amplifier source, particularly of the push-pull type with good quality and fidelity of reproduction, including the full range of musical tones and overtones with well defined brilliancy.

These and other objects, as will presently appear, are accomplished by this invention which is fully described in the following specification and shown in the accompanying drawings, in which—

Figure 1 is a front elevation of the push-pull type condenser speaker embodying this invention;

Fig. 2 is an operating circuit diagram therefor;

Fig. 3 is a diagram of a harness unit connector for operating the speaker of Fig. 1 without change in regular wiring assembly of a standard radio set already in use;

Fig. 4 is a section of a construction for the condenser diaphragms used in Fig. 1;

Fig. 5 is a partial section showing a modification of Fig. 4;

Fig. 6 is a plan view of a perforated strip used in the structure of Fig. 4;

Fig. 7 is a sectional end view of the strip of Fig. 6;

Fig. 8 is a plan view of a modified use of strips shown in Fig. 6;

Fig. 9 is a plan view of a modification of Fig. 8; and

Fig. 10 is a partial sectional view of a modification of Fig. 4.

Referring to Fig. 1, a stretcher frame 1 carries a dielectric diaphragm 7 upon which two separate flexible metal foil electrodes 2, 3 are mounted, separated by a gap 14 on the insulating sheet 7. The electrode 4 has end reinforcing strips of soft lead 4, 4 pasted

thereon with mucilage, or otherwise secured thereon in electrical contact. The electrode 3 consists of thin metal foil strips 8, 8, 8 rolled over varnished dielectric sheet 7 while said varnish is still wet, and overlapped at rib portions 6, 6.

The electrode 2 is similarly constructed with metal foil strips of aluminum or tin 9, 9, 9, smoothed over a varnished surface of dielectric sheet 7. Japan gold size is a suitable varnish to use for this purpose, because of its conducting qualities. Metal foil 9 is overlapped at rib portions 11, 11. A gap 14 separates electrode 3 from electrode 2. Also, a margin is left bare at 13 around the dielectric diaphragm sheet 7. A tinsel connector strip 15 contacts with end metal ribbon 4 to serve as a terminal for electrode 3. A similar terminal 10 is fastened to the strip 5 of electrode 2, at 16. The co-operating flexible electrode diaphragm at rear side of dielectric diaphragm 7 will presently be discussed after referring first to circuit connections of Figs. 2 and 3, in order that the purpose of the double electrodes 2, 3 may be made clear.

In Fig. 2, a push-pull type vacuum tube amplifier 25 has an input 23 which may be connected to a radio set or other electrical sound unit, and an output choke coil 24. The two amplifier vacuum tubes 21, 22 are connected to the coil 24 in a customary manner. Power unit 20 supplies energizing current to the amplifier 25 when the plug 19 is connected to a source of electric current. A polarizing power unit 18 supplies about 300 volts of direct potential to polarize the acoustic condenser 17. The positive terminal of unit 18 connects to the filaments of vacuum tubes 21 and 22. The flexible condenser electrode 37 co-operates with the diaphragm 7, and is connected to the negative pole of the unit 18.

One of the double electrodes on the diaphragm 7, namely electrode 3, connects to the plate of vacuum tube 21, while electrode 2 also carried by diaphragm 7 connects to the plate of vacuum tube 22. A by-pass condenser 26 of 1 mfd. capacity is shunted across the polarizer power unit 18. Unit 18 is provided with an energizing plug connector 19^a for attachment to a current supply source.

This combination is suitable for use on a push-pull amplifier already in service without necessitating wiring changes.

A suitable harness unit for this purpose is shown in Fig. 3. Two identical adapter plugs 34, 35 are connected by two wire cables 32, 33 respectively, so that the filament terminal of plugs 34 and 35 extends through three wire cable 36 to connector 31 at the positive terminal of polarizer unit 18. The other two wires 29, 30 of cable 36 extend from the plate terminals respectively of adapter plugs 34, 35 to the two condenser electrodes 2, 3, carried on diaphragm 7 of condenser 17. Wire 28 extends from the negative terminal of the polarizer power unit 18 through the cable 27 to the flexible electrode 37 of the acoustic condenser 17.

The vacuum tubes, 21, 22 of Fig. 2 are inserted in connector plugs 34, 35 respectively before use so as to obtain the auxiliary connections aforesaid through the cable 36. Radio sets having push-pull type amplifiers made for low voltage transformer output can thereby be operated with the condenser speaker 17 without requiring a new high voltage output transformer therein.

Referring to Fig. 4, the flexible diaphragm electrode 37 is permeable to air flow, and consists of a metal tinsel cloth 37 reinforced with cross connector narrow lead foil strips 39, which have perforations 45, as shown in Fig. 6. The diaphragm dielectric sheet 7 is spaced from the flexible electrode 37 by a thin air gap 40, and a portion of one of the electrodes 2 carried on diaphragm 7 is shown as a thin metal cloth 41 fastened thereto.

The lead, aluminum, or other metal strips as 39 are preferably secured to the metal tinsel cloth by soldering or welding. Thus solder 39^a may be applied to the back of the metal strip (Fig. 7) and this is then pressed firmly against the tinsel cloth by a hot soldering iron or a hot roll, when the solder will unite the cloth firmly to the strip. Strips of thin solder the width of the metal strip 37 may also be used.

A modified structure is shown in Fig. 5. An extra fabric 42, such as linen crash, carries electrode 37 loosely separated therefrom by air gap 43. Flexible electrode 37 has the same structure as in Fig. 4, with tinsel cloth 38 reinforced by narrow perforated lead strips 39.

Dielectric diaphragm 7 carries the electrode 2, and is separated from the electrode 39 by a tiny air gap 40. The fabric 42 is permeable to air but restricts the amplitude of vibration of the diaphragm electrode 37, thereby softening high pitched tone response therefrom.

Referring to Figs. 6 and 7, the soft lead ribbon strip 39 has a plurality of perforations 45 permitting air to flow therethrough during service. As shown in Fig. 8, length-

wise perforated strips 44, 44 and crosswise disposed perforated strips 47 may be supported on a fabric sheet 47 to serve as a flexible diaphragm electrode in lieu of the tinsel cloth 38 used for electrode 37 of Fig. 4.

The metal strips 39 may be spaced closer together at the center of the frame, thereby causing the center to respond more readily to notes of low pitch, while the side areas respond better to high pitch notes. This result is also obtained by using strips of different widths, different thicknesses, different spacings, and different materials.

A further modified construction for electrode member 37 is shown in Fig. 9. No supporting fabric is used, but instead a special tinsel cloth is woven with fine tinsel cross threads 48, and wider tinsel strands 49, lengthwise interposed with strengthening fabric threads 50.

A modified structure for the dielectric diaphragm assembly is shown in Fig. 10, where the empire cloth sheet 7 has a varnish size layer 52 on which aluminum foil 2, prepared with a roughened or electrolytic dielectric film formed surface 51, is caused to adhere.

The tinsel cloth may be made of either flat or crinkled tinsel strands as disclosed in my earlier application, Serial No. 354,233, filed April 11, 1929, the crinkled tinsel cloth giving a more effective response, probably because of the greater working area.

While I have shown and described but a few embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made which do not depart from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In an acoustic condenser having electrodes and a co-operating dielectric sheet therefor, the improvement which comprises attaching perforated soft metal strips to one of said electrodes to control the vibrations thereof.

2. An acoustic condenser consisting of a flexible perforated soft metal electrode, a dielectric diaphragm adjacent thereto, and a co-operating flexible electrode carried on said diaphragm.

3. An acoustic condenser comprising a flexible perforated lead foil electrode, a second flexible foil electrode, and a dielectric sheet placed between said electrodes.

4. An acoustic condenser comprising a dielectric diaphragm, an electrode carried thereon, and a co-operating electrode therefor comprising a flexible woven metal cloth having a plurality of combined connector and vibration controlling strips combined therewith.

5. An acoustic condenser comprising a fabric sheet, a frame to stretch said sheet, a

- flexible electrode permeable to the flow of air carried by said sheet, a dielectric diaphragm mounted adjacent to said electrode, and an electrode coating carried by said diaphragm, whereby said fabric sheet assists in controlling the vibrations of said flexible electrode carried thereon. 70
6. An acoustic condenser comprising two flexible electrodes, one of which is permeable to air flow while the other is not, and a dielectric diaphragm therebetween. 75
7. An acoustic condenser comprising electrodes, and a co-operating dielectric diaphragm therefor, one of said electrodes comprising a crinkled metal tinsel cloth. 80
8. An acoustic condenser comprising electrodes, and a co-operating dielectric diaphragm therefor, one of said electrodes comprising a woven metal fabric. 85
9. In an acoustic condenser having a dielectric diaphragm and co-operating electrodes therefor, means to fasten one of said electrodes to said diaphragm consisting of a varnish size coated on said diaphragm, characterized by the fact that one surface of said last named electrode is roughened to increase the area thereof exposed to the adhesion of said varnish size. 90
10. An acoustic condenser comprising a flexible electrode permeable to the flow of air, a co-operating diaphragm therefor, and a second electrode carried on said diaphragm and having a wrinkled surface to increase the effective area thereof. 95
11. An acoustic condenser comprising an electrode permeable to air, a dielectric diaphragm placed adjacent thereto, and an electrode having a roughened film surface thereon carried by said diaphragm. 100
12. An acoustic condenser comprising an electrode permeable to air flow, a dielectric diaphragm adjacent thereto, and a plurality of separate electrodes carried by said diaphragm. 105
13. An acoustic condenser for operation on a push-pull amplifier output comprising an electrode permeable to air flow, a dielectric diaphragm placed close thereto, and two separate and insulated electrodes carried on said diaphragm. 110
14. An acoustic condenser comprising a dielectric diaphragm carrying two separated flexible electrodes, and a common co-operating electrode placed adjacent and close to said diaphragm. 115
15. An acoustic condenser having two electrodes, and a dielectric therebetween, one of said electrodes comprising a metal tinsel cloth, and metal strips soldered or welded thereto. 120
16. An acoustic condenser comprising a frame carrying two electrodes, and a dielectric therebetween, one of which electrodes comprises unequally spaced metal strips secured at their ends to said frame. 125
17. An acoustic condenser comprising a frame carrying two electrodes, and a dielectric therebetween, one of which electrodes comprises spaced metal strips of unequal weight secured at their ends to said frame. 130
18. An acoustic condenser having two electrodes, and a dielectric therebetween, one of said electrodes comprising a metal tinsel cloth and metal strips fastened and electrically connected thereto at spaced distances on said cloth. 75
19. An acoustic condenser comprising a flexible air permeable electrode, a dielectric diaphragm spaced adjacent thereto, a flexible electrode carried on said diaphragm, and a fabric cloth stretched adjacent to said air permeable electrode to dampen the vibrations thereof. 80
20. An acoustic condenser comprising an electrode permeable to air flow, a dielectric diaphragm adjacent thereto, an electrode carried by said diaphragm, and a plurality of flexible strips on the air permeable electrode disposed to contact with spaced areas of said diaphragm to control the air moved when said diaphragm is vibrated. 90

In testimony whereof, I have hereunto set my hand and affixed my seal this 12th day of April, 1929.

PHILIP E. EDELMAN. [L. S.] 95

100

105

110

115

120

125

130