Sept. 12, 1933.

L. YOUNG

1,926,187

DIAPHRAGM FOR SOUND PRODUCING INSTRUMENTS

Filed July 23, 1931

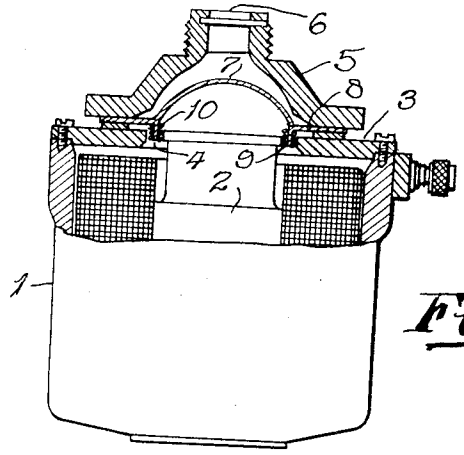


Fig. 1.

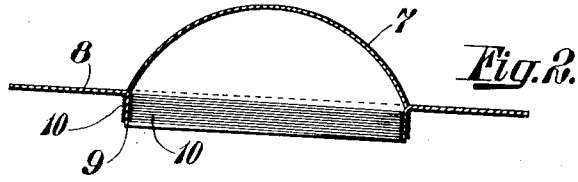


Fig. 2.

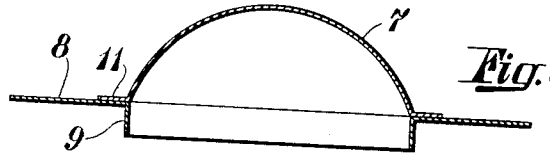


Fig. 3.

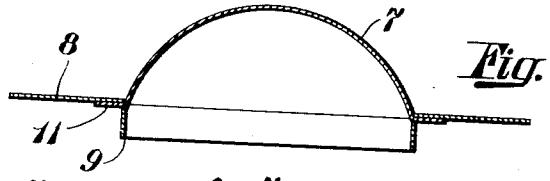


Fig. 4.

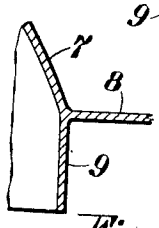


Fig. 5.

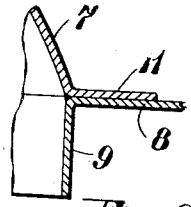


Fig. 6.

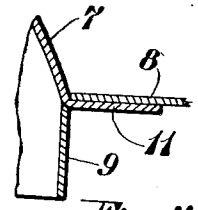


Fig. 7.

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DIAPHRAGM FOR SOUND PRODUCING INSTRUMENTS

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Application July 23, 1931, Serial No. 552,737, and in Great Britain July 30, 1930

5 Claims. (Cl. 181—31)

This invention relates to sound-reproducing instruments of the electro-dynamic type in which a relatively small diaphragm sets up sound vibrations in an acoustic horn, and has for its object to provide in and for such sound-reproducing instruments a diaphragm assembly of a particularly efficient nature with which it is possible to set up vibrations of a comparatively large amplitude without introducing undesirable acoustic distortion or permanent deformation of the parts thereof.

It is well known to provide diaphragms for sound-reproducing instruments formed from the substance known under the registered trade-mark "Bakelite", celluloid, or from paper treated with "Bakelite". Such a diaphragm has previously been proposed comprising a cone having a flat flange embracing the base of the cone formation, the cone and the flange both being formed from paper impregnated with "Bakelite", whilst a further previously proposed form of diaphragm has been constructed of thin and light material, for example of celluloid or paper treated with "Bakelite", and consists of a central conical portion and a ring-shaped corrugated flange-like portion around the conical portion terminating in a rim serving for securing purposes, whilst to the centre of the conical portion, that is to say, to the apex of the conical portion, is fixed, by a suitable glue, cement or the like, a "speech coil" adapted to be electro-dynamically actuated when the device is in use.

According to the present invention, a diaphragm assembly in and for sound-reproducing instruments of the type set forth, is characterized by the fact that it is constructed from one or a plurality of pieces, wholly or mainly of cellulose or similar material, such for example as celluloid or cellulose acetate, or of a synthetic resin such for example as the materials known by the registered trade-marks "Bakelite" or "Celastoid" or other similar synthetic material, and consists of a diaphragm portion proper, a carrying flange for the diaphragm proper, and a portion upon which the moving or speech coil is directly mounted, the whole constituting a unitary structure.

The diaphragm assembly may be built up from a number of parts suitably attached together by a desired cement, "Dope", or other adhesive, or may be moulded in one or more parts or pressed between dies, with or without the application of heat, or by any combination of such means.

In the result, the diaphragm assembly, whether formed from one part, or from a number of parts attached together, comprises a unitary structure with the part carrying the moving or speech coil, and the said diaphragm and associated parts are made wholly from cellulose material or materials and/or synthetic resin or similar materials.

As a consequence, in operation the diaphragm is able readily to vibrate and move a column of air included between itself and the interior of the acoustic horn and that without any appreciable or permanent deformation.

The amplitude of the vibrations can be large and the volume and tone extremely full, rendering devices according to the invention suitable for use in cinemas, theatres and other places, and especially for use to reproduce the sound records in connection with so-called talking films or "talkies".

In order that the invention may be better understood, it will now be described with reference to the accompanying drawing in which:—

Fig. 1 shows in elevation, partly in section, a dynamic unit, for use with a sound-reproducing instrument including an accoustic horn and having a diaphragm assembly constructed according to one embodiment of the invention.

Fig. 2 shows to an enlarged scale a diaphragm assembly as shown in Fig. 1, according to one method of construction.

Fig. 3 shows a view somewhat similar to Fig. 1, of another method of carrying the invention into effect.

Fig. 4 shows yet another method of carrying the invention into effect.

Fig. 5 shows to an enlarged scale a section of a portion of the diaphragm assembly shown in Figs. 1 and 2.

Fig. 6 shows a similar section of the diaphragm assembly shown in Fig. 3, and

Fig. 7 shows again a similar section of the diaphragm assembly shown in Fig. 4.

In the dynamic unit shown in Fig. 1, 1 is the container for the coil formed with the integral core portion 2 and cap member 3 including between the inner circumference of the cap member and the outer diameter of the core the magnetic gap 4 in which the annular speech coil hereafter referred to is connected. To the container 1 is connected the carrier 5 for the amplifier horn (not shown) which horn is connected to the outlet 6. The diaphragm assembly comprises a part spherical portion 7 constituting the diaphragm portion proper, located coaxial with the carrier 5 and outlet 6 and adapted to vibrate the column of air be-

tween itself and the said carrier, outlet and horn. The diaphragm has attached thereto or formed integrally therewith (as hereafter explained) a flange portion 8 held in suitable positions by clamping screws between the cap member 3 and the carrier 5, and in addition to said diaphragm and flange portion 8 carry a somewhat short cylindrical portion 9 of similar material having the speech coil 10 wound thereon both on the interior and exterior, such portion 9 and speech coil being located in the annular magnetic gap 4.

In operation it will be understood that the speech coil through its leads (not shown) is connected to the appropriate circuit, and by the movements of the parts, causes the diaphragm assembly and especially the portion 7 to vibrate the column of air to produce the required sounds.

As before explained, the diaphragm with its associated parts, namely the carrying flange and the carrier for the speech coil, is formed from a cellulose material or from synthetic resin or from similar materials, either from a plurality of parts attached together or as an integral whole.

In Fig. 2, the diaphragm portion proper 7, the carrying flange portion 8 and the cylindrical part 9 for carrying the speech coil 10 are formed as an integral whole and secured in position by suitable clamping screws passing through slots or apertures in the flange 8; certain of the clamping screws may be utilized as terminals and having connected thereto the leads for the speech coil 10.

The joint between the portions 7, 8 and 9 of this form is shown in Fig. 5.

The construction shown in Figs. 3 and 6 is somewhat similar, with the exception that the diaphragm portion proper 7 is formed with an integral flange 11 which is attached by a suitable cement to the flange 8 having formed integrally therewith the portion 9 for carrying the speech coil.

Again, in Figs. 4 and 7, the diaphragm portion proper 7 has a flange 11 attached by a suitable cement, dope or the like to a ring forming the flange 8 and having attached thereto the cylindrical portion 9 by a suitable cement, dope or otherwise.

It has been found in practice that with a diaphragm assembly constructed according to the invention, much better results are produced than if the said diaphragms and associated parts were made from metal in the form of foil or otherwise or by woven fabric, stiffened by dope, varnish or otherwise, as owing to the flexibility of the parts and their power of ready recovery, the amplitude of the vibrations can be comparatively large without any permanent deformation of the said parts.

The actual diaphragm portion proper in practice has given good results when made from sheet "Celastoid" of 0.010" thick, which after being die pressed and stretched, is substantially .007" thick, the flange portion 8 being formed from "Bakelite" paper of .003" thick with the ring 9 for carrying the speech coil from celluloid or Celastoid strip .002" thick, the parts being attached together by a suitable cement, dope or otherwise under pressure

In some cases for the dynamic unit, the core of the container can be formed separate from the main body and attached thereto, and the end of the main body if desired may be formed separate from the outer casing, the parts being suitably attached.

Again, although a cap 3 with a step has been shown attached by screws to the outer casing of the container 1, this cap can be formed in other ways for association with the container.

The invention is not limited to the precise forms or details of construction described, as these may be varied to suit particular cases, for example in cases where the diaphragm assembly is constructed from a plurality of pieces, the particular class of cellulose or similar material from which any one or more of the individual pieces is formed, can be chosen at will and combined in any suitable manner.

What I claim and desire to secure by Letters Patent of the United States of America is:—

1. A sound reproducing unit comprising a container, a coil in the container having a centrally arranged core, a cap on the container having a circular opening concentric with and of greater diameter than the core, so that an annular magnetic gap is formed around the core, a diaphragm having a central cross sectionally concavo convex portion and a depending annular flange, said diaphragm being arranged with its convex side opposed to the cap its concave side spaced from the core and with its annular flange in the said annular air gap, a conducting coil on said depending flange to which the speech currents to be amplified are applied, and means securing the outer portion of the diaphragm on the cap.

2. A sound reproducing unit as claimed in claim 1, including a carrier bearing on the outer portion of the diaphragm and having a substantially semi-cylindrical chamber on its inner side in which the convex side of the concavo convex portion of the diaphragm is arranged, said carrier also having means to enable a horn to be attached thereto.

3. In a sound reproducing unit of the class described, a diaphragm comprising a disc having a centrally arranged cross sectionally concavo convex portion and a flange extending around said concavo convex portion and depending from said disc.

4. A diaphragm as claimed in claim 3, made of cellulose composition.

5. A diaphragm as claimed in claim 3, made of a composition containing synthetic resin.

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