

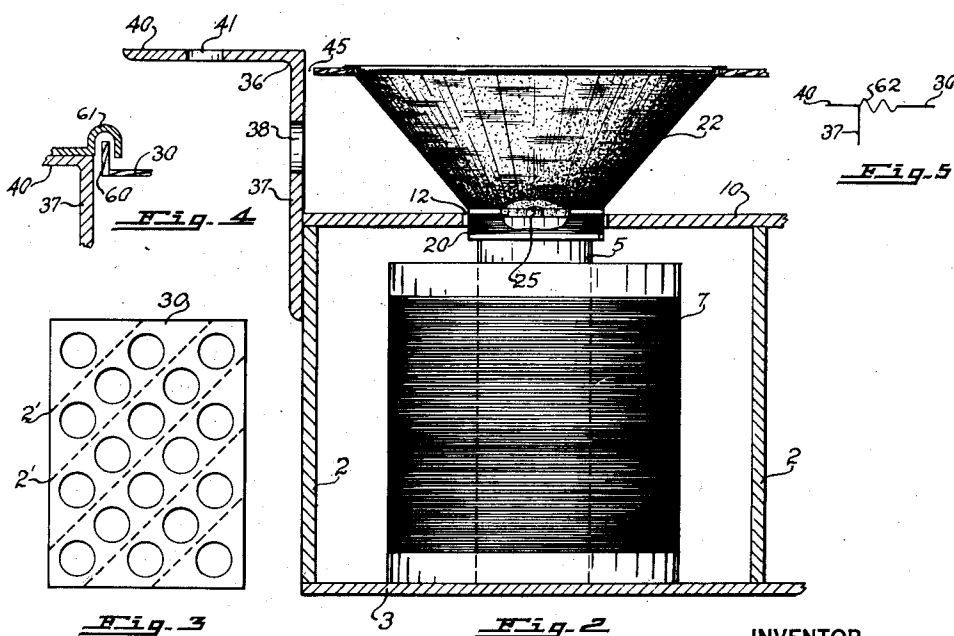
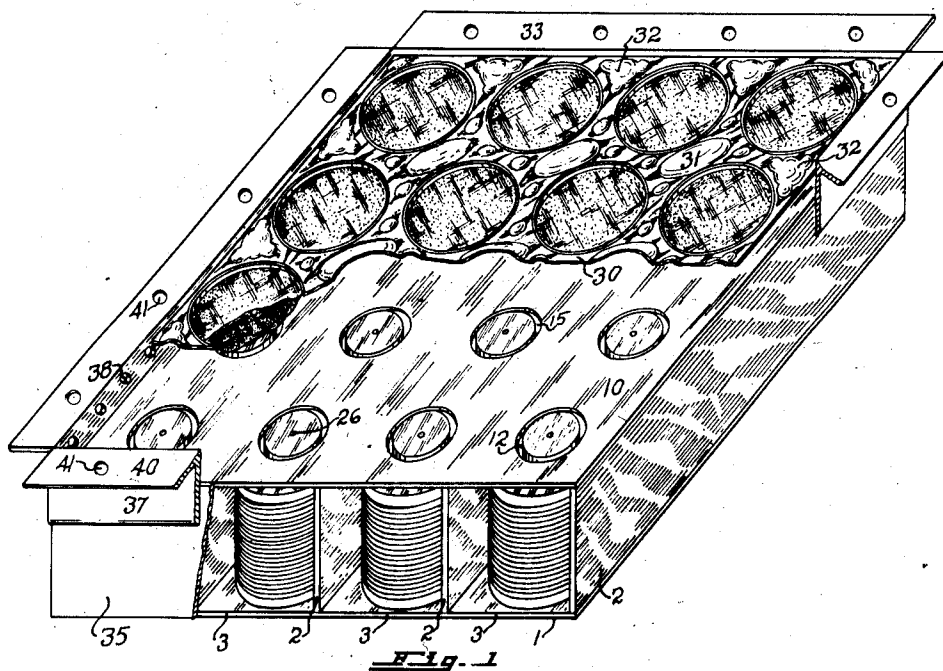
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ELECTRICAL APPARATUS

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ELECTRICAL APPARATUS

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This invention relates to electrical apparatus, and particularly to loud speakers. This invention relates especially to that class of speakers whose output is of sufficient volume for use in auditoriums, theatres, public address systems, and the like.

In order to obtain sufficient output from a speaker to satisfy the above purposes, it is necessary to do more than merely increase the size of ordinary loud speakers. Thus, for example, with the electromagnetic type of speaker, great volume of undistorted output is a practical impossibility because of inefficiency of translation and the practical possibility of making a satisfactory unit on a large scale. As soon as the ordinary diaphragm of such a unit is inordinately increased in size, it no longer functions as a simple diaphragm actuated from a central region, but functions as a highly complex diaphragm in which not only the entire region vibrates as a unit, but also smaller regions of varying shapes and sizes function simultaneously as sub-units. Obviously, the larger the diaphragm, the more complex this performance becomes, with the result that the more complicated becomes the relation between the driving force and the diaphragm response. In such a case, undistorted reproduction is impossible. Furthermore, because of the extremely unstable nature of the degeneration of the diaphragm into small separately vibrating units, it is a practical impossibility to provide any compensation.

This problem has been attacked by disposing a plurality of similarly actuated incomplete electro-magnetic units in co-operative relationship to a single diaphragm, having small portions thereof complete each unit as a translating means. This, however, requires each peripheral portion of the diaphragm co-operating with an incomplete unit to be restrained in some manner to obtain the proper flexing action of the central portion of each diaphragm unit with relation to the fixed peripheral portion thereof. Such a construction is unsatisfactory for various reasons. Thus, the construction is inherently expensive, and in order to obtain the required volume would require an excessive number of

separate units, each of which would have to be comparatively small in order to function efficiently and faithfully. Furthermore, in such a construction, the plurality of small diaphragms operating as separate acoustic units would result in distortion in a manner similar to that produced by the large diaphragm previously mentioned.

Substantially the same objections obtain with the electrostatic speaker, since the only practical form of the device requires a flexing of a variable portion of the diaphragm with relation to the rest.

An object of this invention is to devise a speaker which will reproduce efficiently and faithfully at high levels of volume.

A further object is to devise such a structure in which a single large acoustic element acts as a simple generator of sound, but which at the same time is actuated at a plurality of points.

In general, this invention contemplates the provision of a plurality of translating units of any type, each one of which is fully capable of completely translating electrical impulses into mechanical impulses, said units being operatively associated with a single acoustic element and substantially supporting said element. This single element is bodily vibrated and acts as a piston to set up vibrations in air. Since the element is given mechanical impulses rather than having such impulses created therein, it is clear that if the various complete translating units are similarly energized, the entire member will be given uniform translatory impulses throughout its entire extent. Hence, the element will tend to act as a simple diaphragm.

While any type of translating unit may be employed, or combinations of several types, for the sake of making the mechanical resonance of the system uniform for various frequencies, it is preferred to employ electrodynamic units. Each such unit is preferably provided with a flexible, conical diaphragm of paper, or stiffened woven material, the small end of which is suitably engaged by the moving element of each unit. The large end of each cone, which may be circular or elliptical, is fastened to a single large

diaphragm, preferably flat. The large diaphragm is made of any rigid material such as metal, wood or similar material and has apertures therein where the large ends of the flexible cones engage. It is possible, however, to omit the cones as intermediate connections between the moving coils and large diaphragm. The cones may, if desired, be rigid, such as of metal integral with the large diaphragm.

To maintain the load on the large diaphragm at the periphery thereof, means are provided for preventing substantial leakage of air around the edges of the large diaphragm during operation. This may take on a variety of forms as disclosed hereinafter.

While the large diaphragm may be operated as described, it is preferable to provide means for promoting the functioning of said large diaphragm as a simple diaphragm and inhibit degeneration into a plurality of separately vibrating smaller diaphragms. This means may be local discontinuities or deformations of the diaphragm at spaced intervals to increase the rigidity thereof.

In the drawing,

Figure 1 is a perspective view, with portions cut away, of a speaker embodying this invention;

Figure 2 is a sectional view of one of the speaker units;

Figure 3 is a diagrammatic showing of a different arrangement of the speakers with reference to the diaphragm.

Figure 4 is a detail of a modified form of air baffle for the diaphragm edge;

Figure 5 is a diagrammatic showing of a flexible support for the diaphragm edge.

Referring to Figures 1 and 2, the speaker comprises a metal base 1 provided with a plurality of parallel spaced upstanding metal walls 2. Parallel walls 2 divide bases 1 into a plurality of long strips 3. Base 1 and walls 2 are preferably of iron or some magnetic material and form portions of the magnetic circuits of the various translating units.

Suitably anchored to base 1 at spaced intervals along each strip 3 are a plurality of upstanding cores 5 of magnetic material. Disposed around each core is a field energizing coil 7. Lying parallel to base 1 and supported by the coplanar top edges of walls 2 is a metal plate 10 of magnetic material. Together with base 1 and walls 2, plate 10 forms a cellular housing for the various field coils. Plate 10 is provided with apertures 12 into which project the ends of cores 5. The tops of cores 5 may be flush with plate 10 and form annular airgaps 15.

Disposed within each airgap 15 is a voice coil 20 having suitable leads (not shown) adapted to be connected to a source of audio frequency currents. It is immaterial whether the voice coils are connected in series or parallel, so long as they are similarly energized.

The same holds true for the field coils. As is well known, voice coils 20, when energized by varying currents, tend to vibrate up and down transversely of the magnetic field.

Each voice coil 20 is rigidly mounted on the small end of a conical diaphragm 22. This conical diaphragm may be made of stiff paper, sized fabric, or the like. The rigidity of this diaphragm is substantially equal to that of a similar diaphragms in the usual dynamic speakers. Each cone 22 is flexibly anchored to the top of cooperating core 5 by a bolt 25 threaded into aperture 26. The large end of each cone 22 has its edge rigidly fastened to a large diaphragm at the edges of apertures therein. Diaphragm 30 may be of any material of suitable rigidity such as metal, wood, etc. Since this diaphragm is moved bodily and should not have any vibrations set up between portions thereof, the nature of the material employed has no substantial effect on reproduction. This is in marked contrast to diaphragms having relative motion between various portions thereof.

In order to increase the rigidity of diaphragm 30 and inhibit vibration in it, struck up portions 31, 32 and 33 are provided in the spaces between the cones. This provision, however, is not essential in every case and may be varied to suit conditions.

With the various units similarly energized, it is clear that diaphragm 30 will be vibrated up and down throughout its entire extent. This diaphragm is solely supported by the various conical members, and is, therefore, free to move in this fashion.

End walls 2, together with transverse walls 35, (only one of which is visible) support angle irons 36 at their upper portions. These irons consist of a vertical wall 37 provided with a plurality of apertures 38 and a horizontal portion 40 having a plurality of apertures 41. Apertures 38 are provided for equalizing the air pressure on both sides of wall 37 beneath diaphragms 30 while apertures 41 are for mounting the device.

To prevent the unloading of diaphragm 30 at its periphery by escape of air around the edge, I preferably extend diaphragm 30 so that only a small clearance 45 is provided at stationary wall 37. This clearance should be large enough to take care of any yielding of cones 22 if the speaker is mounted vertically and may be determined by manufacturing tolerances.

In Figure 3 is shown diagrammatically a packed arrangement of the cones on diaphragm 30. In such a case vertical walls 2' will be at an angle to the sides of the device. Of course, any shape of base may be used instead of the rectangular, shown in the drawing.

In Figure 4, I have shown a modified form of air baffle for the edge of diaphragm 30. Disposed around the periphery of 30 and ex-

tending perpendicularly from the plane thereof is a wall 60 adapted to telescope with a U shaped member 61 fixedly supported by portion 40 of the angle irons 36. While wall 60 extends upwardly from diaphragm 30, it is evident that equally effective results may be obtained by a reverse arrangement.

In Figure 5, a flexible ribbon 62 joins angle irons 37 and the edge of diaphragm 30 and prevents air leakage.

I claim:

1. A loud speaker, adapted to convert electrical impulses into acoustic energy at high energy levels, comprising a plurality of similarly energized translating units adapted to transform electrical impulses into mechanical impulses, a single acoustic member, and means operatively and supportably associating said plurality of translating units with said acoustic member whereby said member is actuated at a plurality of points and is supported by said same points to function as a simple acoustic diaphragm.

2. A loud speaker comprising a plurality of similarly energized translating means for changing electrical impulses into mechanical impulses, a plane diaphragm, and means for operatively and supportably associating said diaphragm with said translating means whereby said diaphragm is actuated at a plurality of points and is supported by said same points to function as a simple acoustic member.

3. A loud speaker comprising a plurality of similarly energized translating means for changing electrical impulses into mechanical impulses, a diaphragm, means for operatively and supportably associating said diaphragm with said translating means, the points of support being the same as the points of actuation, and means associated with said diaphragm for inhibiting the degeneration of said diaphragm into a plurality of separately vibrating smaller diaphragms.

4. A loud speaker comprising a plurality of similarly energized translating means adapted to change electrical impulses into mechanical impulses, a diaphragm operatively and supportably associated with said translating means whereby said diaphragm is energized at a plurality of points and functions as a simple diaphragm, the points of support being the same as the actuating points, and means associated with the peripheral portion of said diaphragm for substantially preventing leakage of air around the diaphragm periphery during operation thereof.

5. A loud speaker comprising a plurality of similarly energized translating units adapted to transform electrical impulses into mechanical impulses, a single plane diaphragm operatively associated with said translating means and supported thereby and adapted to function as a simple diaphragm,

and means co-operating with the peripheral portion of said diaphragm to prevent any substantial leakage of air around the edges thereof during operation.

6. A loud speaker comprising a plurality of similarly energized translating means adapted to change electrical impulses into mechanical impulses, a single diaphragm operatively associated with said means and supported thereby and adapted to function as a simple acoustic member, means associated with said diaphragm for inhibiting degeneration thereof into a plurality of separately vibrating smaller diaphragms, and means associated with the peripheral portion of said diaphragm for preventing any substantial leakage of air around the edge of said diaphragm during the operation thereof.

7. A loud speaker comprising a plurality of similarly energized translating means adapted to change electrical impulses into mechanical impulses, a single diaphragm, and a plurality of vibratable means operatively associating said translating means and said single diaphragm, said diaphragm being supported thereby.

8. A loud speaker comprising a plurality of similarly energized translating devices adapted to change electrical impulses into mechanical impulses, a single diaphragm, a conical member associating each of said translating means with a portion of said single diaphragm and supporting the diaphragm, and means associated with said single diaphragm for inhibiting degeneration thereof into a plurality of separately vibrating smaller diaphragms.

9. A loud speaker comprising a plurality of similarly energized translating means adapted to change electrical impulses into mechanical impulses, a single diaphragm, conical diaphragms associating said single diaphragm with each of said translating means and supporting said diaphragm, and means associated with the peripheral portion of said single diaphragm for preventing leakage of any substantial amount of air around the edges during the operation of said diaphragm.

10. A loud speaker comprising a plurality of similarly energized translating devices of the electro-dynamic type for translating electrical impulses into mechanical impulses, and a single plane diaphragm operatively associated with and supported by said translating devices.

11. A loud speaker comprising a plurality of similarly energized electro-dynamic translating devices for translating electrical impulses into mechanical impulses, each of said devices including a conical diaphragm and a single plane diaphragm operatively associated with and supported by said conical diaphragms.

12. A loud speaker comprising a plurality-

ty of similarly energized electro-dynamic translating means for translating electrical impulses into mechanical impulses, each of said devices including a conical diaphragm, a single plane diaphragm operatively associated with and supported by said conical diaphragms, and means co-operating with the peripheral portion of said single diaphragm for preventing any substantial leakage of air around the edges thereof during operation.

13. A loud speaker comprising a plurality of similarly energized electro-dynamic translating devices for transforming electrical impulses into mechanical impulses, each of said devices including a conical diaphragm, a single plane diaphragm operatively associated with said conical diaphragms and supported thereby, means associated with said diaphragm for inhibiting degeneration into a plurality of separately vibrating smaller diaphragms, and means operatively associated with the peripheral portions of said diaphragm for preventing any substantial leakage of air around the edges during operation.

14. A loud speaker comprising a plurality of similarly energized electro-dynamic translating units, each unit including a conical diaphragm, means for supporting said units in substantially co-planar relationship, a single plane diaphragm operatively associated with said conical diaphragms and substantially supported thereby, and telescoping means on the periphery of said single diaphragm for preventing any substantial leakage of air around said edges during operation.

15. A loud speaker comprising a plurality of similarly energized electro-dynamic translating units, each unit including a conical diaphragm having a free outer edge, means for supporting said units in regular formation in co-planar relationship, a single diaphragm located in the plane of the free edges of said conical diaphragm, said single diaphragm having suitable apertures therein registering with said conical diaphragms, the free edges of said conical diaphragms being fastened to the edge portions of said apertures, and struck-up portions in said single diaphragm separating adjacent apertures whereby said single diaphragm functions as a simple acoustic member.

16. A loud speaker comprising a plurality of similarly energized translating units of the electro-dynamic type, each including a conical diaphragm, means for supporting said units in co-planar relationship, a single diaphragm operatively associated with said conical diaphragms and supported thereby, struck-up portions in said single diaphragm for preventing degeneration of said diaphragm into separately vibrating smaller diaphragms, and telescoping means co-act-

ing with the peripheral portion of said single diaphragm for preventing any substantial leakage of air around the edges during operation.

17. A loud speaker comprising a plurality of translating units similarly energized and adapted to transform electrical impulses into mechanical impulses, a plane diaphragm operatively associated with said units and supported thereby, a member disposed along the edge of said diaphragm and projecting therefrom normal to the diaphragm plane, and a stationary U-shaped member telescoping said projecting member.

18. A loud speaker comprising a plurality of translating units similarly energized and adapted to transform electrical impulses into mechanical impulses, a plane diaphragm operatively associated with said units and supported thereby, a stationary member adjacent to and substantially paralleling the edge of said diaphragm and a continuous flexible member joining said diaphragm edge and said stationary member.

19. A loud speaker comprising a plurality of translating units similarly energized and adapted to transform electrical impulses into mechanical impulses, a plane diaphragm operatively associated with said units and supported thereby, a stationary member adjacent to and substantially paralleling the edge of said diaphragm, said stationary member and diaphragm edge having a small clearance whereby substantial leakage of air around the edge during operation is prevented.

20. A loud speaker comprising a base plate of magnetic material, a plurality of spaced upstanding magnetic partitions disposed on said plate and adapted to divide said plate into parallel strips, at least one magnetic core disposed in each of said base strips and extending upwardly between adjacent partitions, said partitions and cores being of the same height, field coils surrounding said cores, an apertured magnetic plate disposed over said partitions, said apertures being larger than said cores and adapted to be concentric therewith forming an annular air gap around each core tip, a voice coil disposed in each of said air gaps, a conical diaphragm rigidly secured to each voice coil and being anchored at the center of each core, and a diaphragm completely supported and energized by all said conical diaphragms.

21. A loud speaker comprising a magnetic base plate, a plurality of upstanding magnetic partitions dividing said plate into spaced strips, a plurality of magnetic cores disposed in each of said strips and extending upwardly from said base between adjacent partitions, said cores and partitions being of equal height, an apertured magnetic top plate disposed over said partitions, said apertures being larger than said cores and adapted to be concentric therewith to form

an annular air gap at each core tip, a field coil disposed around each magnetic core, a conical diaphragm having a voice coil at its small end disposed in each of said annular air gaps, and a single plane diaphragm completely supported and energized by all said conical diaphragms.

In testimony whereof I affix my signature.

VICTOR T. PARÉ.

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