July 14, 1931. C. C. BRADBURY 1,814,119

LOUD SPEAKING APPARATUS

Filed Sept. 3, 1929

Fig. 4.

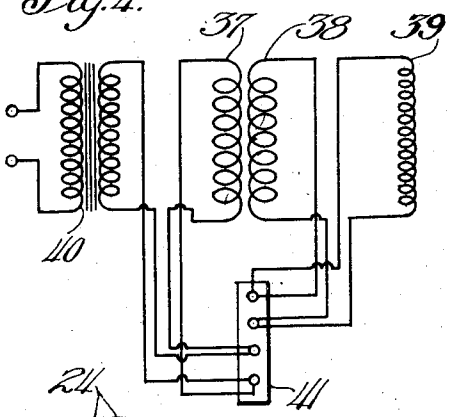


Fig. 1

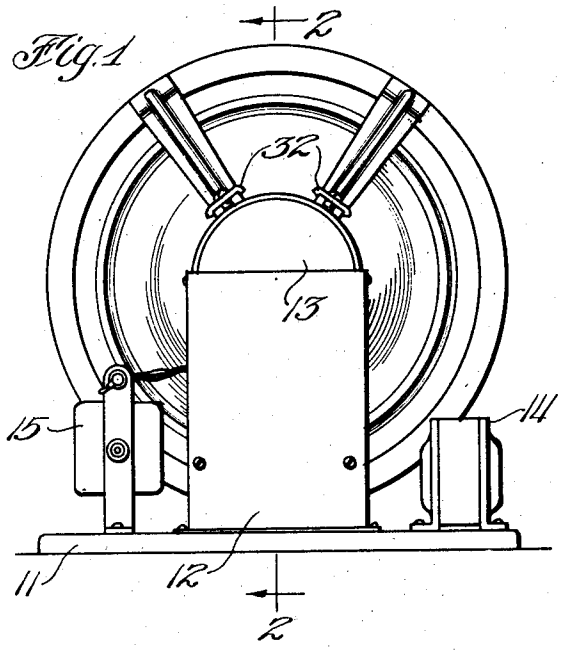


Fig. 2

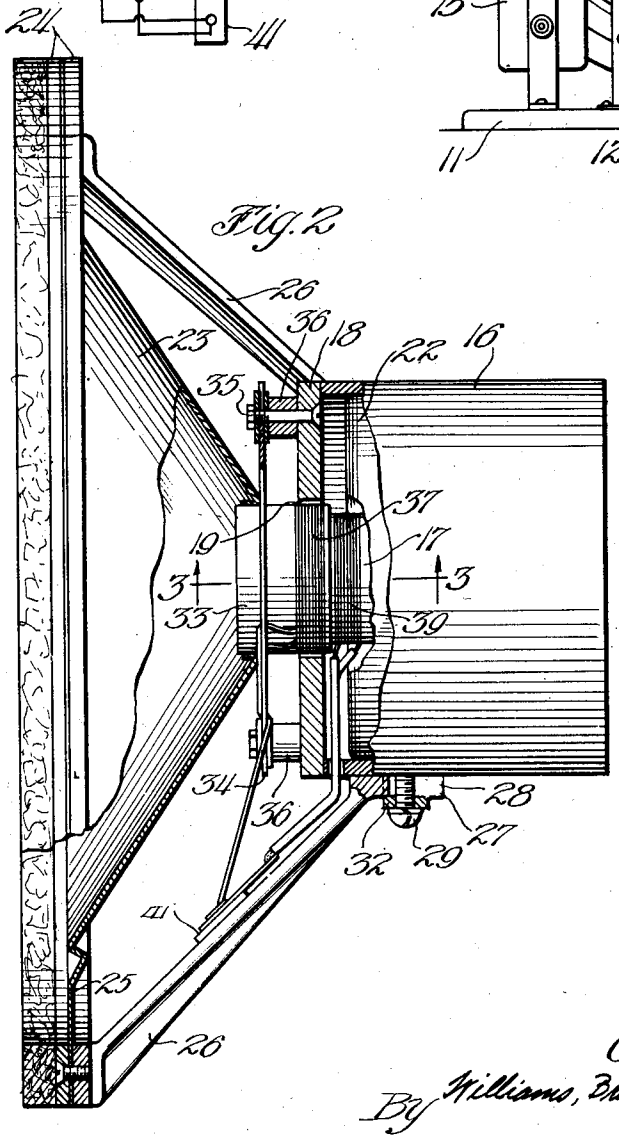
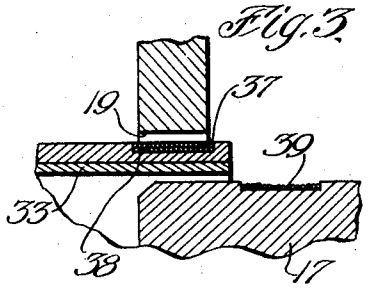


Fig. 3.



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UNITED STATES PATENT OFFICE

CLIFFORD C. BRADBURY, OF GLENCOE, ILLINOIS

LOUD SPEAKING APPARATUS

Application filed September 3, 1929. Serial No. 389,903.

My invention relates to a loud speaking apparatus and more particularly to a device for eliminating noises from the speaker. In employing an automatic rectifier for energizing the field coil of a dynamic type of loud speaker there is a noticeable hum in the speaker due to the fact that uni-directional rectified current has an alternating component which results in a varying magnetic flux in the magnetic circuit of the speaker. This varying magnetic flux induces a current in the telephone current coil tending to move this coil in one direction or the other, depending upon the direction of the induced current and thereby produce a movement of the cone of the speaker in accordance with the variations of the flux resulting in a noise in the speaker.

An object of the invention is to produce a new and improved loud speaker.

A further object is to provide a loud speaker in which the force applied to the cone by the induced current in the telephone coil is balanced by the current in a similar coil associated with a telephone current coil.

A further object is to provide a device for eliminating the hum in a loud speaker caused by the flux variations in the loud speaker.

A further object is to provide a device in a loud speaker which will effectively balance the effect of induced current in the telephone coil.

A further object is to provide a loud speaker energized by current having a pulsating component in which the noises due to the pulsating component are eliminated.

Other objects and advantages will appear as the description proceeds.

In accordance with the general features of the invention, a movable telephone current coil carried by the cone or diaphragm of a dynamic type loud speaker extends into the air gap of a magnetic circuit energized by a rectified current. A neutralizing coil is also carried by the cone or diaphragm which is mounted in juxtaposition to the telephone current coil and is placed in series with a generating coil associated with the same magnetic circuit, for producing a current in the neutralizing coil to counteract the effect of induced currents in the telephone coil.

Referring to the drawings:

Fig. 1 is a rear elevation of a loud speaker embodying my invention and showing a transformer and rectifier associated therewith;

Fig. 2 is an enlarged side elevation, partly in section, of the speaker with its base removed;

Fig. 3 is an enlarged fragmentary, sectional view of the magnetic air gap and the movable coils mounted therein; and

Fig. 4 is a diagrammatic view of the telephone current and neutralizing circuits.

The apparatus comprises, in general, a base 11 having a support 12 upon which the loud speaker 13 is mounted, a step-down transformer 14 and an electronic rectifier 15.

The magnetic circuit comprises a cup-shaped member 16 having a central pole piece 17 mounted concentrically therein and an annular pole piece 18 having a central aperture forming an air gap 19 with the central pole piece 17. A field coil 22 is wound upon the central pole piece and contained within the cylindrical housing formed by the cup-shaped member 16 and pole piece 18. The field coil is energized from the rectifier 15 which is supplied with alternating current by the transformer 14, the latter being adapted to be connected to any suitable source of alternating current supply.

A cone 23 having a flat peripheral margin 25 is supported at its base between annular rims 24. The inner rim is provided with a plurality of arms 26 which converge toward the cylindrical housing. The ends 27 of the arms are provided with longitudinal slots 28 and are held against the cylindrical housing by screws 29 which retain U-shaped washers 32 over the ends of the arms to clamp the arms upon the housing.

The apex of cone 23 has a cylinder 33 mounted thereon which extends into air gap 19 of the magnetic circuit. Cylinder 33 is held concentrically in the air gap by a spider 34 secured to pole piece 18 by screws 35 and spaced therefrom by washers 36,

This cylinder is adapted to carry a telephone current coil 37 which is conductively connected to the secondary of a transformer 40 energized by a receiving set of any suitable type (not shown).

A neutralizing winding 38 is also carried by cylinder 33 and is mounted upon the portion of the cylinder extending into the air gap. Neutralizing coil 38 is connected in series with a generating coil 39 wound upon the end of central pole pieces 17. The ends of all of the coils, as well as of the secondary of the transformer 40, may be brought down and interconnected upon a terminal block 41 for convenience in assembling the apparatus.

The operation of the apparatus is as follows:

Transformer 14 is connected in any suitable manner to an alternating current supply, energizing field coil 22 with a uni-directional pulsating current from the rectifier 15. The wave form of the magnetic flux in the magnetic circuit will correspond to the wave form of the current so that a flux of varying magnitude will exist in the air gap into which the telephone current coil 37 extends. The varying magnetic flux in this air gap induces a current in coil 37. The induced current in this coil in conjunction with the magnetic flux will produce a movement of the cone and result in a noise in the speaker. In order to overcome this objectionable feature, the coil 38 which may be co-extensive and have the same number of turns as coil 37 is provided upon the cylinder 33 and is connected to a generating coil 39 in the same magnetic circuit.

The coil 39 should have a larger number of turns than the winding 38 so that when these windings are connected differentially the larger number of turns in winding 39 will cause a current to flow in coil 38 which is opposite in direction to the induced current in coil 37. The number of turns in coil 39 are so chosen as to produce a current in coil 38 which is opposite and equal to the induced current in coil 37. Thus when a current is flowing in coil 37 and an equal opposite current is flowing in coil 38 the flux in the air gap will have no tendency to move the cone since the force applied to one of the windings is counteracted by the force applied to the other winding with the result that the varying magnetic flux will have no effect in moving the cone due to induced currents in the telephone current coil and, therefore, no noise due to this fact will result.

It is not essential that coil 38 should have the same number of turns as coil 37—all that is necessary is that the ampere turns of these coils should be equal so that if coil 38 is provided with a smaller number of turns than coil 37 a larger current will have to be applied thereto.

The apparatus of the invention provides a convenient means for energizing a dynamic type of loud speaker and at the same time eliminates the objectionable hum found in speakers in which the effect of induced currents from the varying rectified current is not compensated for.

Having described the nature and embodiments of my invention, what I claim is new and desire to secure by United States Letters Patent is as follows:

1. In a loud speaking apparatus, a magnetic circuit providing an air gap, a telephone current coil extending into the air gap and movable therein, a neutralizing coil movable with the telephone current coil and extending into the air gap, and a generating coil conductively connected to the neutralizing coil to neutralize the effect of induced currents in the telephone current coil.

2. In a loud speaking apparatus, a magnetic circuit having an air gap, a sound producing member, a telephone current coil carried by said member and extending into the air gap, a neutralizing coil carried by said member in close proximity to the telephone current coil, and a coil associated with the magnetic circuit for generating a current for the neutralizing coil equal and opposite to the induced current in the telephone coil resulting from flux variations in the magnetic circuit.

3. In a loud speaking apparatus, a magnetic circuit, means for energizing the magnetic circuit, a sound producing member, a telephone current coil carried by the sound producing member, a neutralizing coil carried by the sound producing member, and a generating coil having a larger number of turns than the neutralizing coil and associated with the magnetic circuit for generating a current for the neutralizing coil.

4. In a loud speaking apparatus, a magnetic circuit comprising a cup-shaped member, a central pole piece mounted therein, an annular pole piece secured to the cup-shaped member and forming an air gap with the central pole piece, a cone for reproducing sounds, a telephone current coil carried thereby and extending into the air gap, a neutralizing coil extending into the air gap, and a generating coil wound upon the central pole piece for generating a neutralizing current for the neutralizing coil.

5. In a loud speaking apparatus, a magnetic circuit providing an air gap, a telephone current coil extending into the air gap, a neutralizing coil extending into the air gap and mechanically coupled to the telephone current coil, a generating coil in series with the neutralizing coil connected thereto in such a direction that the current generated in the generating coil and flowing

through the neutralizing coil is opposite in direction to induced currents in the telephone current coil caused by flux variations.

6. In a loud speaking apparatus, a magnetic circuit having an air gap, a field coil for energizing said circuit, an alternating current rectifier for energizing the field coil, a cone for reproducing sounds, a cylinder carried by said cone having a portion extending into the air gap, a telephone current coil carried by the cylinder and extending into the air gap, a transformer adapted to be connected to a receiving set, the secondary of said transformer being connected in series with the telephone current coil, a neutralizing coil co-extensive with the telephone current coil and having an equal number of turns, a generating coil wound upon the central pole piece and having a larger number of turns than the neutralizing coil and means for interconnecting the neutralizing coil and the generating coil whereby a current is caused to flow in the neutralizing coil which is equal and opposite to the current induced in the telephone current coil.

7. In a loud speaking apparatus, a magnetic circuit, means for supplying an energizing current therefor, means for eliminating the effect of variations of the energizing current comprising a neutralizing coil, and a generating coil differentially connected thereto, said generating coil having a larger number of turns than the neutralizing coil.

8. In a loud speaking apparatus, a magnetic circuit, means for energizing the magnetic circuit, a sound producing member, a telephone current coil carried by the sound producing member, a neutralizing coil carried by the sound producing member, and a generating coil differentially connected in series with the neutralizing coil and more subject to variation of the magnetic circuit than the neutralizing coil and associated with the magnetic circuit for generating a current for the neutralizing coil.

9. In a loud speaking apparatus, a magnetic circuit, means for supplying an energizing current therefor, means for eliminating the effect of variations of the energizing current comprising a neutralizing coil, and a generating coil differentially connected thereto, said generating coil being more subject to change of magnetic circuit than the neutralizing coil.

In witness whereof, I hereunto subscribe my name this 30th day of August, 1929.

CLIFFORD C. BRADBURY.