Jan. 24, 1928. 1,657,124

H. H. IDE

REPRODUCER

Filed Dec. 26, 1924

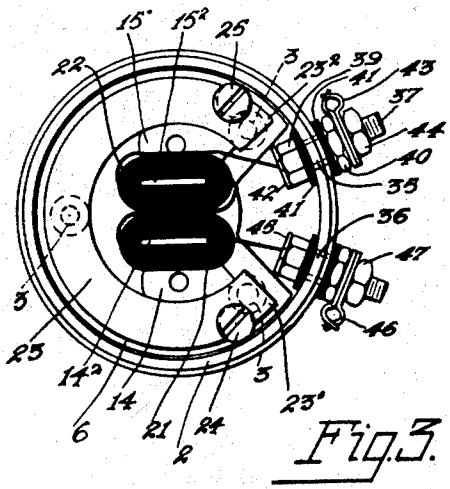

Fig. 3.

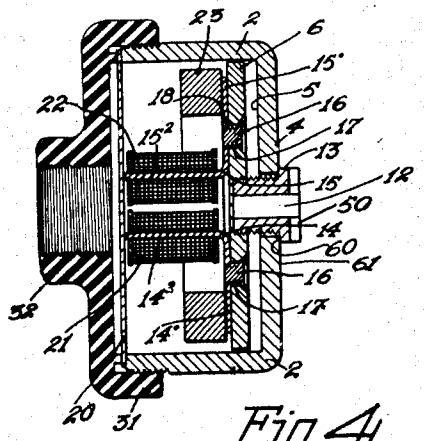

Fig. 4.

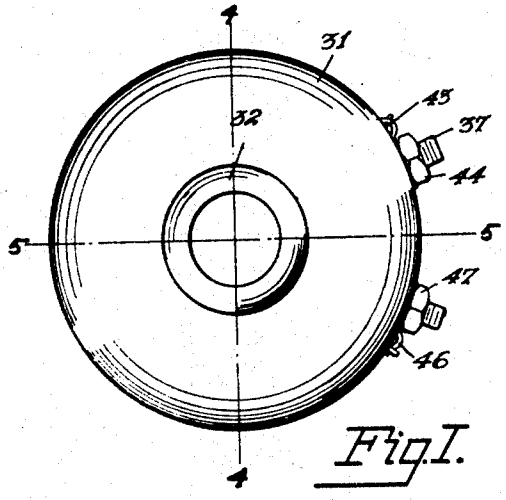

Fig. 1.

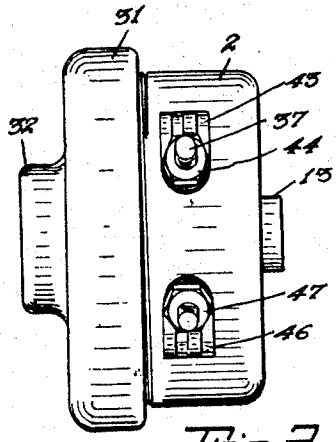

Fig. 2.

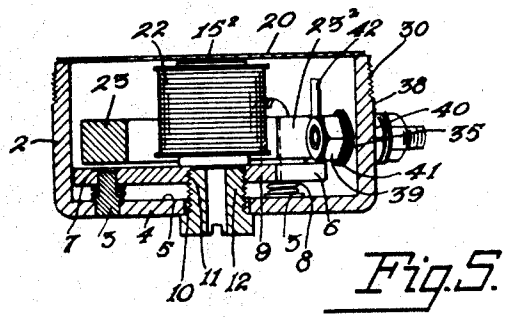

Fig. 5.

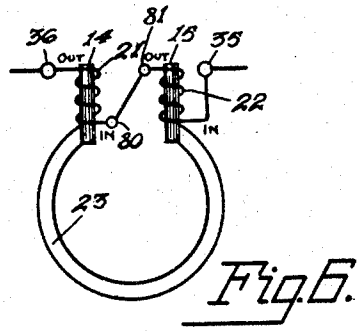

Fig. 6.

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1,657,124

UNITED STATES PATENT OFFICE.

HARRY H. IDE, OF LA GRANGE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

REPRODUCER.

Application filed December 26, 1924. Serial No. 758,012.

My invention relates to reproducers and has to do more particularly with loud speaker units as they are commonly known in the radio art and an object of my invention is the provision of a reproducer or receiver of this type which is provided with novel features of construction and assembly of parts to produce a reproducer which is most efficient in its operation.

In loud speakers or reproducers of the type now in use the construction is such that the diaphragm is affected by the magnets when current is passing through the coil windings, to cause the diaphragm to vibrate to emit sound. The diaphragm in the vicinity of the pole pieces is caused to dip due to force exerted by the magnets in attracting the diaphragm and this "dipping" of the diaphragm at its center produces a ripple or chatter when the current undulates and causes distortion of the sound. To overcome this objection I have devised means of connecting the windings of the reproducer magnets of my invention so that as the current passes through the windings the diaphragm is attracted and released in a manner to eliminate said chatter or ripple as this method of connecting the windings causes one of the magnets to act as a buffer or check on the diaphragm activity both toward and from the pole pieces, thus preventing distortion.

Another feature of my invention is the provision of a supporting means for the pole pieces and associated apparatus, which are supported as a whole on springs; and I provide adjustable means associated with this supporting means for moving the supporting means as a whole up or down in its enclosing cup to vary the air gap between the pole pieces and the diaphragm to obtain the maximum efficiency for a clear and perfect reception of sound.

The above features as well as others not specifically pointed out will be more fully described in the ensuing specification and appended claims.

For a more complete understanding of my invention reference may be had to the accompanying drawing in which like reference characters in the several views denote like parts and in which

Fig. 1 is a plan view of the reproducer of my invention;

Fig. 2 is a right side view of Fig. 1;

Fig. 3 is a plan view of the reproducer with the cap and diaphragm removed to clearly illustrate the interior apparatus;

Fig. 4 is a sectional view along the line 4—4 of Fig. 1;

Fig. 5 is a sectional view along the line 5—5 of Fig. 1 and

Fig. 6 diagrammatically illustrates the reproducer and the method of connecting the coils of the reproducer.

Referring now more in detail to the reproducer of my invention it comprises a cup shaped member 2 formed of suitable metal such as brass and in which I adjustably secure the mechanism of the reproducer. Three pins 3 equally spaced apart are secured to the base 4 of the cup member 2 and project up from the face 5 of the base 4 into the interior of the cup member 2. A disk 6 of suitable metal such as brass is provided with three orifices 7 which are in alignment with the three pins 3 which extend up into these three orifices 7 when the disk 6 is placed into position. A helical spring 8 is placed around each pin 3 and rests between the face 5 of the base 4 of the cup member 2 and the bottom face 9 of the disk 6 for purposes as will presently be described. The base 4 of the cup member 2 is provided with a central orifice 10 and the disk 6 which rests upon the helical springs 8 is provided with a tapped orifice 11 in alignment with the central orifice 10 in the cup member 2. A threaded stud 12 provided with a slotted head 13 passes through the orifice 10 in the base 4 of the cup member 2 and has screw threaded engagement with the tapped orifice 11 in the disk 6 for purposes as will presently be described.

Angular pole pieces 14 and 15 are secured to the disk 6 by means of screws 16 which pass through suitable orifices 17 in the disk 6 and have screw threaded engagement with

suitable tapped orifices 18 in the extended portions 14′ and 15′ of the pole pieces 14 and 15. The portions 14^2 and 15^2 of the pole pieces 14 and 15 which extend upward in proximity to the diaphragm 20 carry the magnet coils or spools 21 and 22. The permanent magnet 23 is placed within the cup member 2 and is semicircular in shape and is constructed of steel or other suitable material which is permanently magnetized and fits along the inner periphery of the cup member 2 with its ends 23′ and 23^2 terminating over the portions 14′ and 15′ of the pole pieces 14 and 15. Screws 24 and 25 are provided and pass through suitable orifices in the ends 23′ and 23^2 of the permanent magnet 23 and have screw threaded engagement with suitable tapped orifices in the disk 6, which when turned down clamp the permanent magnet 23 in position against the portions 14′ and 15′ of the pole pieces 14 and 15. The cup member 2 is provided with external threads 30 at its forward end upon which is screwed a cap 31 of suitable material such as hard rubber or bakelite. The cap 31 when screwed down securely clamps the diaphragm 20 against the circumferential end of the cup member 2. The cap 31 is provided with an integrally formed extended member 32 which is internally threaded and is adapted to receive a suitable sleeve member for connecting it as a unit to a projector or horn.

A pair of binding posts or terminals 35 and 36 are secured to the cup member 2 and as both are alike a detailed description of one will suffice. The terminal 35 comprises a stud 37 which passes through a suitable insulation sleeve which extends through a suitable orifice in the side wall 38 of the cup member 2. Nuts 39 and 40 are provided and have screw threaded engagement with the protruding ends of the stud 37 and clamp the same in position against rotation, and suitable insulation washers 41 are placed between the nuts 39 and 40 to insulate them from the cup member 2. A suitable terminal 42 is secured to the stud 37 in any suitable manner and the respective terminal end of the winding of the magnet coil 22 is soldered thereto. A suitably formed clip 43 is clamped in position on the stud 37 by a nut 44 and this clip 43 is adapted to receive the external cord terminal connection. A terminal 45 is also provided with terminal 36 to which is soldered the terminal end of the magnet coil 21 and a clip 46 secured to the terminal 36 by means of a nut 47 is adapted to receive the other external cord terminal.

Having described in detail the apparatus of the reproducer of my invention I will now describe how the disk 6 and its supported apparatus is adjustably secured as a whole in the cup member 2. The disk 6 and its supported apparatus may be adjusted as a whole up or down relative to the clamped diaphragm 20 to change the air gap between the diaphragm 20 and the pole pieces 14^2 and 15^2. When the stud 12 is turned in a clockwise direction through the agency of a suitable tool which is placed in the slot 50 in the head 13 of the stud 12, due to the fact that the stud 12 is in screw threaded engagement with the tapped orifice 11 in the disk 6 this turning of the stud 12 in a clockwise direction permits the helical springs 8 around the pins 3 between the face 5 of the base 4 and the face 9 of the disk 6 to force the disk 6 and its supported pole pieces 14 and 15 up due to the turning of the stud 12 closer to the diaphragm 20 which is clamped in position by the cap 31. The disk 6 in its upward movement, which is caused by the springs 8 is guided by the pins 3 which extend up into the aligned orifices 7 in the disk 6 and the pins 3 in addition to serving as means for guiding this upward movement of the disk 6 and its supported parts as a whole also prevent the disk 6 from tilting in its movement and also prevent the disk 6 from turning when the adjusting stud 12 is turned. To move the disk 6 and its supported pole pieces 14 and 15 down to widen the air gap between the pole pieces 14 and 15 and the diaphragm 20, the stud 12 is turned in a counterclockwise direction and this rotation of the stud 12 draws the disk 6 and its supported pole pieces 14 and 15 down against the tension of the helical springs 8. The helical springs 8 around the pins 3 are placed under compression when the stud 12 and disk 6 are connected through the medium of their threaded connection and the tension of the springs 8 tends to force the disk 6 and its supported parts up causing the face 60 of the head 13 of the stud 12 to be held in frictional engagement with the face 61 of the base 4 of the cup member 2 and this friction between these two faces 60 and 61 is sufficient to hold the stud 12 against movement after the air gap between the pole pieces 14 and 15 and the diaphragm 20 has been set. The disk 6 and its supported pole pieces 14 and 15 as a whole is floated upon the springs 8 and the tension of the springs 8 in combination with the guide pins 3 permit vertical movement of the disk 6 as it rests upon the spring 8 at three points equidistant apart and the threaded stud 12 when turned in a clockwise or counterclockwise direction to permit movement of the disk 6 through the agency of the springs 8 causes the disk 6 to move up or down without tilting.

Referring now to Fig. 6 I illustrate diagrammatically the apparatus of the reproducer of my invention showing the pole pieces 14 and 15 in association with the permanent magnet 23 and the magnet coils rep-

resented by the windings 21 and 22. As current passes through the winding 21 on the pole piece 14 in one direction and increases to maximum the magnetism of the pole piece is increased to a maximum. This current which also passes through the winding 22 on the pole piece 15 tends to neutralize the pole piece overcoming the normal magnetization set up by the permanent magnet 23. When the current reaches its maximum point the pole piece 14 has built up to a maximum and the pole piece 15 has decreased. Now as the current decreases to normal the force set up in the pole piece 14 decreases until it reaches its normal point whereas the pole piece 15 will build up until it reaches its normal point. As the force of the pole piece 14 decreases the diaphragm 20 is released but the building up of the force of the pole piece 15 tends to retard the movement of diaphragm 20 and this action of the attraction of the pole piece 15 tends to act as a check or buffer and prevents the diaphragm 20 from springing back with a snap. This action of the forces of the pole pieces 14 and 15 with current passing through their windings 21 and 22 permits the diaphragm 20 to follow the impulses of current which pass through the windings 21 and 22 on the pole pieces 14 and 15. The windings 21 and 22 on the pole pieces 14 and 15 are both wound in the same direction but the inside terminal winding 80 of the winding 21 on the pole piece 14 which is connected to the outside terminal winding 81 of the winding 22 on the pole piece 15 produces this effect upon the pole pieces 14 and 15 as above described to affect the vibration of the diaphragm 20 so as to prevent "any dipping".

With the reproducer constructed and its windings 14 and 15 connected as just described the objections to reproducers or loud speaker units now in use is overcome as the action of the pole pieces 14 and 15 on the diaphragm 20 prevents the area of the diaphragm at the pole pieces from "dipping". This "dipping" and the ripple accompanying it is caused by the pull exerted by the pole pieces and their release, as the current decreases to normal, and is the cause of much of the distortion. To overcome this action in the reproducer by the cushioning action of the pole pieces which prevents this "dipping" as is experienced in the loud speakers now in use is an object of my invention.

While I have illustrated and described a preferred embodiment of my invention it is to be understood that changes and modifications will readily suggest themselves to those skilled in the art and I therefore aim to cover all such changes as come within the spirit and scope of the appended claims.

Having described my invention what I claim as new and desire to secure by United States Letters Patent is:

1. A device of the character described including a permanent magnet and a pair of pole pieces, a diaphragm normally held under stress by said magnet and pole pieces, windings for said pole pieces so connected that the excursion of movement of the diaphragm is dampened when undulating current is passed through said winding.

2. A device of the character described including a magnet and a pair of pole pieces, a diaphragm associated with said pole pieces, windings for said pole pieces so connected that when current is passed through the same in one direction, one pole piece tends to exert a force on said diaphragm while the other pole piece tends to dampen its movement.

3. A device of the character described including a magnet and a pair of pole pieces, a diaphragm associated with said pole pieces and located on one side of said pole pieces, windings for said pole pieces so connected that when current is passed through the same in one direction one pole piece is further magnetized while the other pole piece tends to demagnetize.

4. A device of the character described including a magnet and a pair of pole pieces, a diaphragm associated with said pole pieces and located above said pole pieces, windings for said pole pieces so connected that when the current undulates therethrough the pole pieces alternate in becoming further magnetized and de-magnetized.

5. A device of the character described, including a diaphragm, a magnet and a pair of pole pieces located below said diaphragm and exerting a force thereupon, windings for said pole pieces so connected that the excursion of movement of said diaphragm is dampened when undulating current is passed through said windings.

6. A device of the character described, including a diaphragm, a magnet and a pair of pole pieces located below said diaphragm and exerting a force thereupon, windings for said pole pieces so connected that when current is passed through the same in one direction one pole piece tends to exert a force on said diaphragm while the other pole piece tends to dampen its movement.

7. A device of the character described including a diaphragm, a magnet and a pair of pole pieces located below said diaphragm and exerting a force thereupon, windings for said pole pieces so connected that when current is passed through the same in one direction the field density of one pole piece is increased while the field density of the other pole piece is lessened.

8. A device of the character described, including a diaphragm, a magnet and a pair of pole pieces located below said diaphragm

and exerting a force thereupon, windings for said pole pieces so connected that when undulatory current is passed through the same the pole pieces alternate in becoming further magnetized and demagnetized.

9. A device of the character described, including a magnet and a pair of pole pieces therefor, a diaphragm associated therewith, windings for said pole pieces, said windings adapted to be connected to prevent dipping of the diaphragm.

Signed by me at Chicago, in the county of Cook, State of Illinois, this 23d day of December, 1924.

HARRY H. IDE.