April 8, 1930. A. A. THOMAS 1,753,812

LOUD SPEAKING TELEPHONE RECEIVER

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FIG. 1

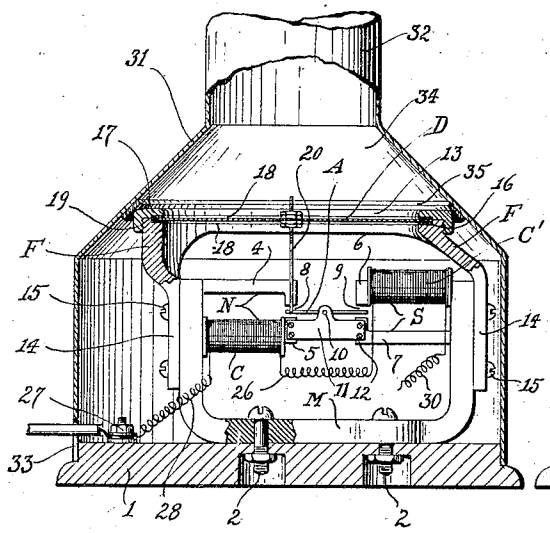

FIG. 2

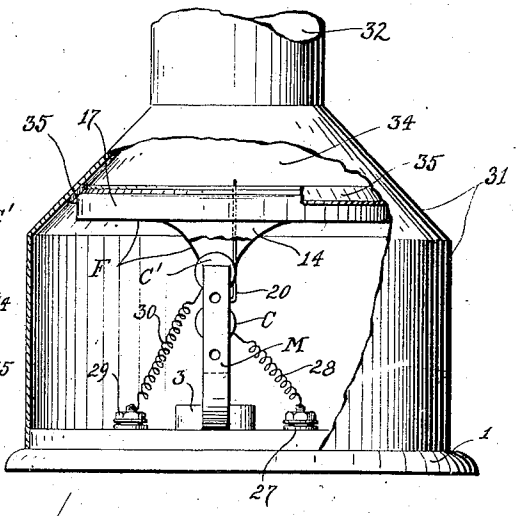

FIG. 3

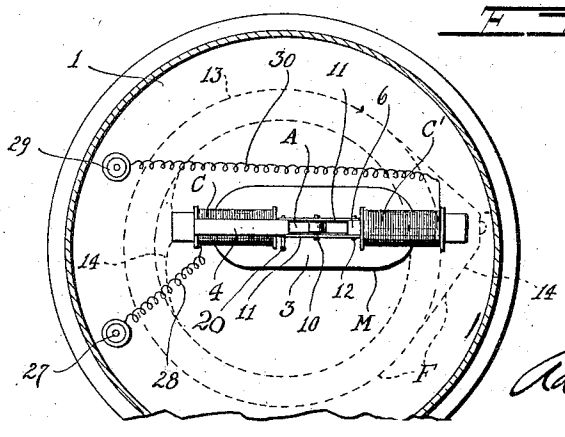

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FIG. 4.

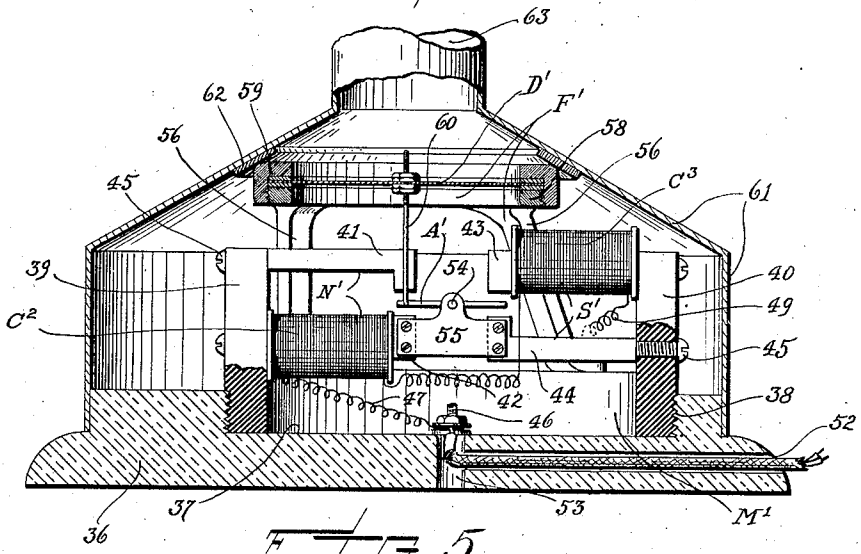

FIG. 5.

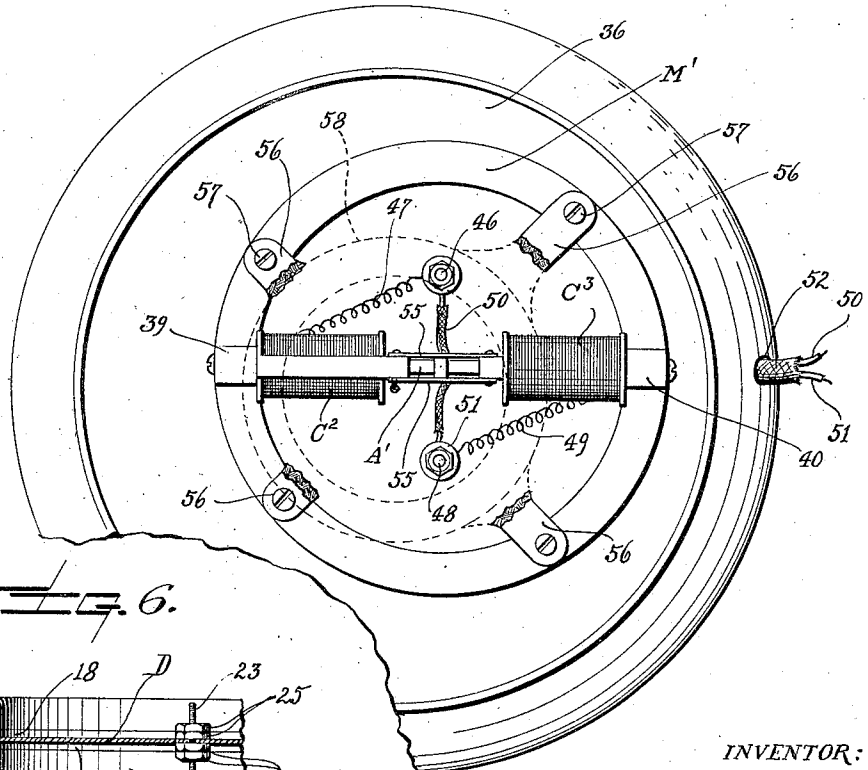

FIG. 6.

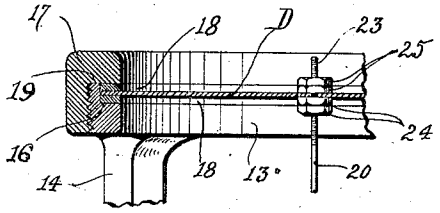

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FIG. 7.

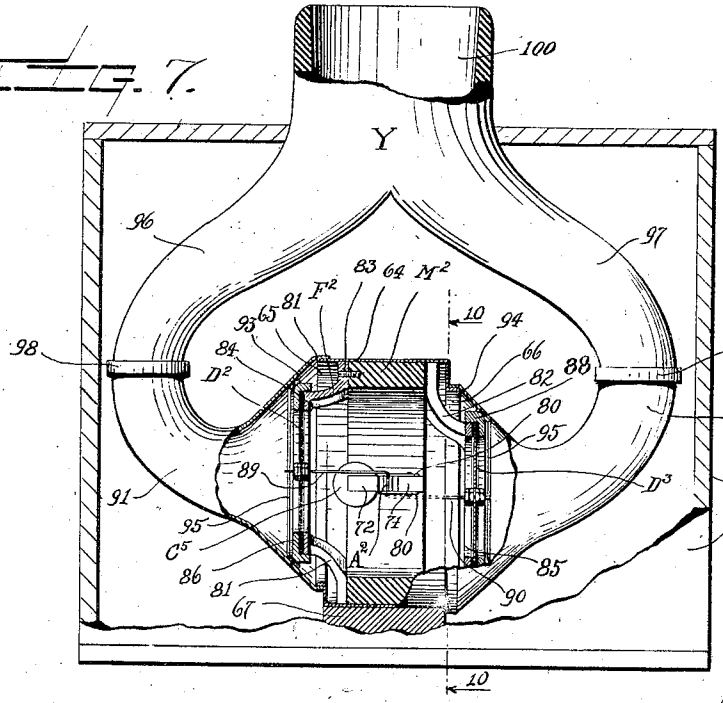


FIG. 8.

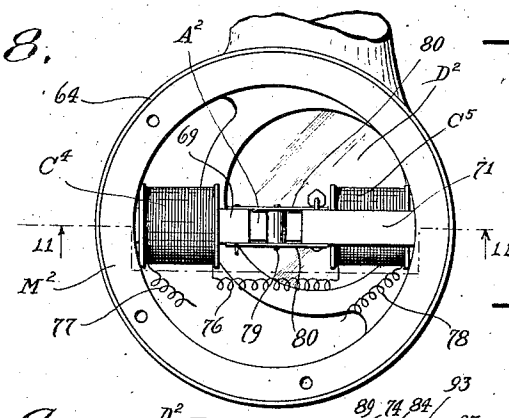


FIG. 9.

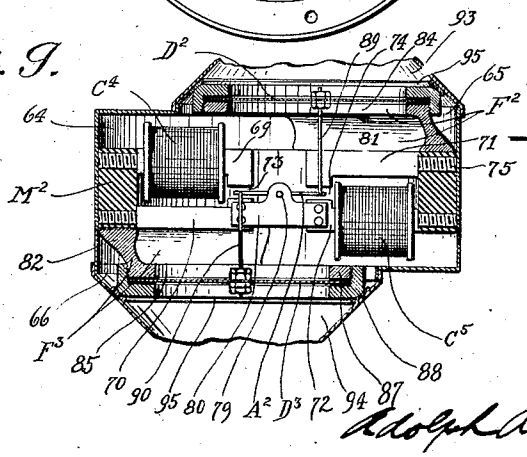


FIG. 10.

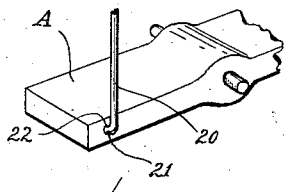


FIG. 11.

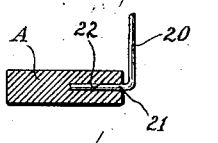
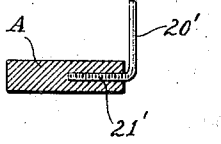


FIG. 12.



INVENTOR:

Adolph Alexander Thomas

Patented Apr. 8, 1930 1,753,812

UNITED STATES PATENT OFFICE

ADOLPH ALEXANDER THOMAS, OF NEW YORK, N. Y.

LOUD-SPEAKING TELEPHONE RECEIVER

Application filed July 3, 1922, Serial No. 572,730. Renewed August 10, 1929.

My invention relates to telephone receivers, and its object is to provide a loudspeaker embodying various features of improvement, as hereinafter described.

According to one feature of my invention, the acoustic diaphragm is mounted in a frame directly carried by the magnet of the electromagnetic mechanism, so that all the operative parts are insertable on, or removable from, the supporting base of the instrument as a unit. This obviates the danger of any disarrangement of the adjusted parts in mounting them within the outer casing of the loudspeaker.

Another feature of my invention provides for completely cutting off the space containing the electromagnetic mechanism from the acoustic chamber above the diaphragm, thereby improving the quality of the reproduction.

Furthermore, my invention permits the use of two diaphragms operated by a single armature for producing sound of increased volume. The vibrations of the two diaphragms are preferably conveyed to a common outlet in the casing of the instrument.

The foregoing and other advantages of my invention will be understood from a detailed description of the accompanying drawings, in which

Fig. 1 is an interior view of a telephone receiver embodying various features of my invention, certain parts being shown in section for clearness;

Fig. 2 is a view at right angles to Fig. 1, certain parts being broken away for clearness;

Fig. 3 is a plan view of the construction shown in Figs. 1 and 2, with the diaphragm and supporting casting indicated in dotted lines;

Fig. 4 is a side view, partly in cross-section, of a telephone receiver having a circular magnet;

Fig. 5 is a plan view of the construction shown in Fig. 4, with the supporting casting for the diaphragm broken away for clearness;

Fig. 6 is a fragmentary detailed view on an enlarged scale to show more clearly the mounting of the diaphragm and the adjustable connection with the armature, this particular form of mounting and connection being merely illustrative;

Fig. 7 shows a telehpone receiver embodying two diaphragms connected to the armature;

Fig. 8 is a cross-section approximately on line 8—8 of Fig. 7, on a somewhat enlarged scale;

Fig. 9 is a bottom sectional view approximately on line 9—9 of Fig. 8, looking in the direction of the arrows;

Fig. 10 is an enlarged fragmentary view showing a convenient way of connecting the diaphragm rod or wire to the armature;

Fig. 11 is a cross-section view of the connection shown in Fig. 10; and

Fig. 12 is a view similar to Fig. 11, showing the rod or wire screwed into the armature.

The loudspeaker shown in Figs. 1, 2 and 3 has a U-shaped magnet, while the construction shown in Figs. 4 and 5 employs a circular magnet. In Figs. 7, 8 and 9, I have shown a loudspeaker embodying two diaphragms for producing increased volume. I will now describe these illustrative embodiments in detail.

Refering first to Figs. 1, 2 and 3, there is a U-shaped permanent magnet, indicated as a whole by M′, secured to a base 1 by any suitable means, such as non-magnetic screws or bolts 2. To accommodate the screws 2, the base of the magnet may be widened, as indicated at 3 in Figs. 2 and 3. The base member 1, usually in the form of a circular plate, may be of non-metallic material, such as porcelain, fiber and the like. To the legs of magnet M are secured divided or bifurcated pole pieces, one of which consists of members 4 and 5, and the other of members 6 and 7. The members or bifurcations 4 and 5 may be assumed to constitute the north pole, and the members or bifurcations 6 and 7 may be considered as the south pole. The polar faces of pole piece N are separated by an air gap 8, and the polar faces of pole piece S are separated by a similar air gap 9. The main body of the permanent magnet M is of hard steel and the pole pieces are preferably of soft iron, either solid or laminated. The polar

members 4, 5, 6 and 7 are secured to the body of the magnet in any suitable way, as any electrician understands. An armature A is mounted in operative relation to the bifurcated pole pieces N and S. This armature is shown in the form of a flat bar pivoted at 10 between a pair of non-magnetic supporting plates 11, which may conveniently be secured to polar members 5 and 7, as by screws 12 or otherwise. The precise mounting of the armature is immaterial, provided it is maintained in proper operative relation to the pole pieces of the magnet.

In Fig. 1, armature A is shown extending into the polar air gaps 8 and 9, and is normally in a position practically midway of the adjacent polar faces. Armature A is preferably of soft iron, like the pole pieces.

On magnet M is mounted a non-magnetic frame indicated as a whole by F. This frame may conveniently be cast in a single piece of suitable non-magnetic metal, such as aluminum, brass and the like. The main portion of frame F consists of a ring 13 from which extends a pair of legs 14. The arrangement and spacing of legs 14 are such that they fit against the legs of magnet M to which they are secured in any practical way as by means of screws 15 or otherwise.

Ring 13 is provided with a recess 16 in which is fitted a diaphragm D. A suitable screw cap 17 holds the diaphragm rigidly clamped in place. If desired, a non-metallic washer 18 may be placed on each side of the diaphragm, as best shown in the enlarger fragmentary view in Fig. 6. The washers 18 may be of paper, fiber or other suitable material. In Figs. 1 and 6, the downward movement of screw cap 17 is limited by a shoulder 19 on ring 13. It is immaterial how diaphragm D is supported, provided it is free to vibrate. Diaphragm D is operatively connected to armature A by a rod or wire 20, preferably of non-magnetic material. The inner end of rod 20 is secured to the armature at or near one end thereof in any suitable manner. For instance, in Figs. 10 and 11, the inner end 21 of rod 20 is bent at right angles to the main portion of the rod and fits tightly in a transverse opening 22 of the armature. In Fig. 12, rod 20′ has a screw-threaded end 21′ fitting in a corespondingly screw-threaded opening in the armature. In practice, the rod 20′ may first be screwed into the armature and then bent at right angles for connection with diaphragm D. Referring to Fig. 6, it will be seen that the outer end of rod 20 is screw-threaded at 23 and passes centrally through diaphragm D. It is preferable that the connection between the diaphragm and armature be adjustable, and for that purpose I have shown two pairs of nuts 24 and 25 on rod 20 at opposite sides of the diaphragm. By means of these nuts, the distance between the diaphragm and armature may be adjusted to the precise length required in any particular case. The use of double nuts prevents the connection from becoming loose. Any other practical connection between armature A and diaphragm D may be employed. The diaphragm is preferably made of some suitable non-magnetic material, such as aluminium, mica, wood, composition, or any other vibratory material capable of responding freely to the vibrations of the armature.

The poles of magnet M are provided with coils C and C′ connected in series, as indicated diagrammatically by a conductor 26. The other end of coil C is connected to a binding post 27 by a conductor 28, and the other end of coil C′ is connected to a binding post 29 by a conductor 30. Although I have shown the coils C and C′ on the diametrically opposite polar members 5 and 6, it is obvious that they might be mounted on polar members 4 and 7. The coils C and C′, which in effect constitute a single coil, are connected in a suitable circuit of variable current, as a telephone circuit, and the current variations produce vibration of armature A in a manner well understood by those skilled in the art. The movements of the armature are transmitted to the diaphragm. Instead of a permanent magnet, I may use an electromanget energized by a source of constant voltage or current to maintain a practically constant magnetic field, like a permanent magnet. In the broader aspect of my invention, any other practical electromagnetic mechanism may be used to operate the acoustic diaphragm.

The mechanism of the loudspeaker above described may be enclosed in an outer casing, such as shown at 31 in Figs. 1 and 2. The lower edge of casing 31 fits snugly to base plate 1 and may be provided with a tubular extension 32 adapted to receive a horn or other sound-directing device. In order to accommodate the outside conductors leading to binding posts 27 and 29, the lower edge of casing 31 has a pair of slots 33, one of which is shown in Fig. 1. Casing 31 is preferably so shaped in its upper portion as to provide a sound chamber 34 which is closed to the lower portion of the casing. If desired, a ring 35 of felt or similar material may be interposed between screw cap 17 and the casing.

In the form of loudspeaker illustrated in Figs. 4 and 5, there is a permanent magnet M′ in the shape of a ring suitably secured to or set into an insulating base plate 36. For simplicity I have shown base plate 36 formed with a recess 37, in which the circular magnet M′ is rigidly held by screw-threads 38 or in any other convenient way. By setting the permanent magnet M′, which is naturally a heavy steel body, into a recess in the non-metallic base plate 36, the posi-

tion of the magnet is lowered and the stability of the entire structure is thereby increased. Magnet M′ is provided with a pair of extensions 39 and 40. To extension 39 are secured polar members 41 and 42, and to extension 40 are fastened similar members 43 and 44. Members 41 and 42 may be considered as the north pole N′ of the magnet and members 43 and 44 as the south pole S′. The polar members or bifurcations 41, 42, 43 and 44 are secured to the extensions 39 and 40 by any practical means, such as screws 45. Coils C^2 and C^3, connected in series, are mounted on bifurcations 42 and 43, respectively. The free end of coil C^2 is connected to a binding post 46 by a conductor 47, and the free end of coil C^3 is connected to a binding post 48 by a conductor 49. Outside conductors 50 and 51 lead to binding posts 46 and 48 through channels 52 and 53 formed in the insulating base plate 36.

Armature A′ is pivoted at 54 and mounted in operative relation to pole pieces N′ and S′ of magnet M′. For the sake of convenience, I have shown armature A′ supported between a pair of non-magnetic plates 55 secured to polar members 42 and 44, similar to armature A of Fig. 1.

A non-magnetic frame, indicated as a whole by F′, is mounted on the circular magnet M′. For this purpose, frame F′ has a plurality of legs 56, so spaced and arranged as to fit on the upper circular edge of the magnet to which they are secured by any suitable fastening means, such as screws 57. The upper portion of frame F′ consists of a ring 58 adapted to receive a diaphragm D′, which is held in place by a cap 59, or otherwise. Diaphragm D′ is operatively connected to armature A′ by a rod or wire 60. Inasmuch as this connection is the same as that shown in Fig. 1, what I have previously stated in detail about the adjustable connection between armature A and diaphragm D may be considered as applying to armature A′ and diaphragm D′, so as to obviate unnecessary repetition.

The working parts of the loudspeaker shown in Figs. 4 and 5 are preferably enclosed in an outer casing, indicated as a whole by 61, which is suitably fastened to base plate 36. A felt or similar washer 62 is preferably interposed between the casing and cap 59. Casing 61 may have a tubular extension 63 for receiving a horn or other sound-conveying device.

One of the advantages of my invention lies in the fact that it permits the use of two diaphragms to be actuated by a single armature, thus increasing the volume of sound. In Figs. 7, 8 and 9, I have shown a loudspeaker employing two diaphragms so arranged that the sound vibrations thereof are conveyed to a common outlet.

Referring now in detail to these figures, there is a non-magnetic cylindrical support 64 having a circular opening 65 at one end and a similar opening 66 at the other end, these openings being eccentric for reasons that will presently become clear. The support 64, which may conveniently be shaped out of sheet metal like aluminum or brass, is mounted on a base member 67 at the bottom of an outer box or casing 68. Within the support 64 is mounted a circular permanent magnet M^2 provided with polar members or extensions 69, 70, 71 and 72, constructed and arranged as shown in Fig. 9. Members 69 and 70 constitute one pole piece (say, the north pole), and members 71 and 72 constitute the other pole piece of magnet M^2. We thus have bifurcated pole pieces in which the respective polar faces are separated by air gaps 73 and 74, similar to the pole pieces in Figs. 1 and 4. It will be observed that the pole pieces 69—70 and 71—72 are arranged in a plane substantially at right angles to the plane of the circular body portion of magnet M^2, similar to the pole pieces of the circular magnet M′ in Fig. 4. The pole pieces are secured to magnet M^2 by screws 75 or in any other way. Coil C^4 is mounted on polar member 69, and coil C^5 is mounted on polar member 72. These coils are connected in series by a conductor 76, as indicated in Fig. 8. The free ends 77 and 78 of the coils lead to suitable binding posts or terminals (not shown) for connecting the loudspeaker in the receiving circuit. Magnet M^2 has an armature A^2 pivoted at 79 between a pair of non-magnetic plates 80, which may conveniently be secured to polar members 70 and 72, similar to the armature support shown in Figs. 1 and 4.

At one side of the magnet M^2 is mounted a non-magnetic frame indicated as a whole by F^2, and at the other side of the magnet is mounted a similar non-magnetic frame indicated as a whole by F^3. These frames may conveniently be cast each in a single piece of aluminum, brass or other suitable material, and in the present instance they are so shaped as to be attachable to the circular body portion of the magnet itself. For this purpose, frame F^2 is formed with legs 81 and frame F^3 with legs 82. These legs are arranged to fit against the opposite sides of magnet M2, to which they are secured in any suitable way, as by screws 83 or otherwise. The frame or casting F^2 is provided with a ring 84, and casting F^3 has a similar ring 85. On ring 84 is seated a diaphragm D^2, held in place by any suitable means, such as a screw cap 86. The frame or casting F^3 is formed with a ring 87 which supports a diaphragm D^3 by means of a screw cap 88 or other clamping arrangement. Diaphragm D^2 is connected to one end of armature A^2 by a link 89, and diaphragm D^3 is connected to the other end of

the armature by a link 90. These connections between the diaphragms and armature A^2 are preferably adjustable, as previously described in detail in connection with Fig. 6, or in any other practical way.

It will be clear from the foregoing that as the armature A^2 vibrates in accordance with current variations in coils C^4 and C^5, as those skilled in the art will understand, the diaphragms D^2 and D^3 vibrate in synchronism with the armature and produce sound waves which are additive in their effect. That is to say, the ultimate acoustic effect of the two diaphragms is practically double that of a single diaphragm.

If desired, the vibrations of diaphragms D^2 and D^3 may be conveyed to a common outlet. For this purpose, I provide sound-conveyors 91 and 92. Sound-conveyor 91 terminates at its inner end in a conical enlargement 93, which fits over the circular opening 65 of casing 64. Similarly, sound conveyor 92 is formed at its inner end with a conical enlargement 94 adapted to fit over the circular opening 66 of casing 64. Members 91 and 92 are preferably removable from casing 64 to permit ready access to the diaphragms and other parts. If desired, a ring 95 of felt or other suitable material may be interposed between the screw caps, which clamp the diaphragms in place, and the adjacent wall of the conical sound-conveyor. The sound-conveying members 91 and 92 curve upwardly and outwardly, and are connected to tubular extensions 96 and 97 of a sound-conveyor indicated as a whole by Y. This part may conveniently be cast as a single piece. The curved tubes 91—92 and 96—97 are so shaped and spaced that they snugly fit into each other, so that they can be connected and separated with ease. These separable joints are indicated in Fig. 7 at 98 and 99. Casting Y has an outlet opening 100 projecting outside of casing 68 and adapted to receive a horn or other sound-conveying device. The inner walls of opening 100 may be made slightly conical to facilitate the attachment of a horn or similar member.

It will be seen from the foregoing that I have provided a telephone loudspeaker of a high degree of sensitiveness and capable of producing sounds of considerable volume. The specific constructions which I have shown and described are merely for the purpose of illustrating and explaining the various features of my invention and are not to be considered as restrictions or limitations. Obviously, the loudspeaker of my invention may be physically embodied in other forms than those herein set forth. In order to promote clearness in the drawings, I have not attempted to present the exact relative proportions of the parts, but have shown the different parts rather spread out and more separated than would be required in actual practice. The precise dimensions of the cooperating parts will naturally depend upon the size and type of any particular device under construction. These are matters within the experimental skill of the ordinary electrician in this particular line of work. When in some of the claims I speak of a diaphragm supported in upright position and an armature mounted to vibrate horizontally, I use the descriptive words "upright" and "horizontally" in a relative sense only—that is, to bring out the right-angled relation of those parts. Obviously, if the instrument is so placed that the diaphragm or daphragms are horizontal, the armature vibrates vertically.

What I claim is:

1. In a telephone receiver, the combination of a base, electromagnetic mechanism mounted on said base, said mechanism including a circular magnet, a non-magnetic frame consisting of a ring having integral legs projecting radially therefrom, said legs terminating in circularly arranged extensions adapted to fit against the annular body portion of said magnet, means engaging said extensions for fastening said legs to said magnet, the parts of said mechanism being held together independently of said frame, and a diaphragm mounted in said ring and operatively connected with said mechanism.

2. In a telephone receiver, the combination of a base, a magnet mounted on said base, said magnet comprising a circular body portion provided with polar projections, a vibratory armature and a coil operatively associated with said polar projections, a non-magnetic frame having legs secured to the circular body portion of said magnet, and a diaphragm mounted in said frame and operatively connected with said armature.

3. In a loudspeaking telephone receiver, a supporting base, a casing mounted on said base and supported thereby, a magnet secured to said base, said magnet being provided with pole pieces, a non-magnetic frame comprising a ring and legs projecting therefrom, means for fastening said legs to said magnet, a pivoted armature operatively associated with said pole pieces, means independent of said frame for supporting said armature, a coil on said magnet to cause vibration of said armature, said coil being held in position independently of said fastening means, a diaphragm carried by said ring and held thereon independently of said casing, and means for operatively connecting said diaphragm to one end of said pivoted armature.

4. In a loudspeaking telephone receiver, a supporting base, a casing mounted on said base and supported thereby, a self-sustained magnet secured to said base, said magnet being provided with pole pieces, a non-magnetic frame mounted as a unit in fixed relation to said magnet, fastening devices for rigidly holding said frame in position, a vibratory

armature operatively associated with said pole pieces, means independent of said frame for supporting said armature, a coil to cause vibration of said armature, means for holding said coil in position indenependently of said fastening devices, a diaphragm carried by said ring and held thereon independently of said casing, and means for operatively connecting said diaphragm to one end of said pivoted armature.

5. In a loudspeaking telephone receiver, a supporting base, a magnet secured to said base, said magnet being provided with pole pieces, a non-magnetic frame mounted as a unit in fixed relation to said magnet, fastening devices for rigidly holding said frame in position, a vibratory armature operatively associated with said pole pieces, means independent of said frame for supporting said armature, a coil to cause vibration of said armature, means for holding said coil in position independently of said fastening devices, and a casing or cover mounted on said base and supported thereby, said casing comprising a cylindrical base section and a conical extension opposite said diaphragm, said conical extension being arranged to constitute a sound conveyor for said diaphragm.

6. In a loudspeaking telephone receiver, a supporting base, a magnet mounted on said base and having a vibratory armature, a non-magnetic frame mounted in fixed relation to said magnet and comprising a supporting ring, a casing mounted on said base and comprising a main section and a conical extension open to the outer air, a diaphragm rigidly mounted on said ring and held thereon independently of said casing, said conical extension being arranged to engage said ring and thereby forming opposite said diaphragm a sound-conveying chamber that is practically closed to the magnetic mechanism operating the diaphragm.

7. In a telephone receiver, a magnet having a pair of upstanding limbs, opposite pole pieces projecting inwardly from said limbs substantially in alignment with each other, a support comprising a pair of non-magnetic plates secured to said pole pieces at opposite sides thereof, an armature centrally pivoted on said support and extending lengthwise from one pole piece to the other, electromagnetic means for producing vibration of said armature about its pivot, and a diaphragm connected to said armature.

8. In acoustic apparatus, a base, a magnet mounted on said base in an upright position, pole pieces on said magnet, a vibratory armature operatively associated with said pole pieces, a pair of non-magnetic frames secured to the opposite sides of said magnet, a diaphragm mounted in each frame, and means for connecting said diaphragms to said armature.

9. In acoustic apparatus, a base, a magnet mounted on said base in an upright position, pole pieces on said magnet, a vibratory armature operatively associated with said pole pieces, a non-magnetic frame at each side of said magnet, a diaphragm carried by one of said frames and connected to one end of said armature, and an acoustic member mounted in the other frame and connected to the other end of said armature.

10. In a telephone receiver, the combination of a supporting base, a magnet rigidly mounted on said base, and having pole pieces extending toward each other, an armature operatively associated with said pole pieces, a coil arranged to cause vibration of said armature, a frame having legs removably secured to said magnet, said magnet being structurally independent of said frame, and an acoustic diaphragm carried by said frame and connected with said armature, said frame and diaphragm being removable from said magnet as a unit without disturbing the mounting of said coil and said armature.

11. In a telephone receiver, the combination of a supporting base, electromagnetic mechanism mounted on said base, a non-magnetic frame mounted in fixed relation to said magnet, a casing mounted on said base and having a conical extension which forms a sound chamber provided with an outlet, and a diaphragm carried by said frame in said chamber and operatively connected with said mechanism, said frame and diaphragm forming a closed partition in said chamber.

12. In a telephone loudspeaker, the combination of a casing, a frame arranged to divide said casing transversely into an outer chamber and an inner chamber, a diaphragm carried by said frame, said diaphragm and frame constituting a partition for closing off the inner chamber from the outer chamber, electromagnetic mechanism in said inner chamber for operating said diaphragm, and a sound passage in said outer chamber.

13. In a telephone receiver, the combination of a casing consisting of a cylindrical section and a conical section, a circular frame arranged to divide said casing into a conical chamber and a cylinder chamber, a diaphragm carried by said frame, said diaphragm and frame constituting a partition for closing off the conical chamber from the cylindrical chamber, electromagnetic mechanism in said cylindrical chamber for operating said diaphragm, and a cylindrical extension on said conical section opposite said diaphragm to form a sound passage and connecting means for an amplifier.

14. In a telephone receiver, the combination of a casing having a conical section, a ring in said section, said ring being arranged to bear against the inclined inner wall of said section, a diaphragm carried by said ring and forming therewith a closed partition across said conical section, electromagnetic mecha-

nism mounted in said casing in a space acoustically separated from said conical section by said partition, and a sound opening at the conveying end of said conical section.

15. In a loudspeaker, a framework, a pair of diaphragms supported by said framework in upright position, a sound tube extending laterally from one of said diaphragms, a magnet structure arranged between said diaphragms, a horizontally vibratory armature pivotally supported on said magnet structure independently of said diaphragms, a coil on said magnet structure for controlling said armature, and a pair of horizontally extending parallel links for connecting said diaphragms to different points of said armature.

16. In a loudspeaker, a base, a pair of ring-shaped supports carried by said base and arranged eccentrically with respect to each other in substantially parallel relation, a diaphragm carried by each support, an electromagnetic structure between said diaphragms, said structure having a pivotally mounted armature arranged to vibrate in a plane substantially at right angles to the planes of said ring-shaped supports, means for supporting said armature independently of said diaphragms, the axial centers of said diaphragms being on opposite sides of the pivot point of said armature, and a pair of parallel links attached at one end to the centers of said diaphragms and at the other end to said armature.

17. A loudspeaker comprising a horizontal base, a circular frame supported in vertical position on said base, a diaphragm carried by said frame, a tubular member arranged laterally with respect to said diaphragm for the passage of sound waves produced by the diaphragm, a magnet structure provided with two pairs of pole pieces arranged in a horizontal plane, a horizontally vibratory armature supported intermediate its ends on said magnet structure independently of said diaphragms, a pair of coils mounted on said magnet structure to control said armature, a second diaphragm supported on said base in upright position, and a pair of links between said diaphragms and said armature for simultaneously operating the diaphragms, said links being attached to said armature at opposite sides of its pivot point.

18. A loudspeaker comprising a cylindrical casing open at opposite ends, a base for supporting said casing in upright position with its axis substantially horizontal, a pair of oppositely arranged diaphragms mounted at the open ends of said casing in upright position, a rod secured to the center of each diaphragm and extending inwardly toward the casing, and electromagnetic mechanism supported in said casing between said diaphragms for simultaneously actuating the same, said mechanism including an upright magnet having vibratory means mounted thereon, the inner ends of said rods being connected to said vibratory means.

19. In a loudspeaker, a magnet structure having two pairs of spaced polar projections arranged to provide a pair of aligned airgaps, non-magnetic brackets fixed to said polar projections, a centrally pivoted armature arranged between said brackets and extending into said airgaps, a coil mounted in operative relation to said polar projections to cause vibration of said armature, a pair of diaphragms mounted on opposite sides of said polar projections, and means for connecting said armature to said diaphragms.

20. In a telephone receiver, a magnet structure having a plurality of pole pieces extending toward each other to form aligned airgaps, a pair of non-magnetic plates secured to said magnet structure in spaced parallel relation, an armature centrally pivoted between said plates in operative relation to said airgaps, electromagnetic means for producing vibration of said armature about its pivot, and a diaphragm connected to said armature.

21. In an electromagnetic translating device, a magnet having pole pieces extending toward each other, a pair of non-magnetic plates secured to opposite sides of said pole pieces and holding them in predetermined spaced relation, a vibratory armature mounted on said plates and arranged between the same in operative relation to said pole pieces, a coil associated with said pole pieces and armature, and means for attaching said pole pieces to said magnet.

22. In an electromagnetic translating device, a magnet having pole pieces extending toward each other, non-magnetic plates secured to opposite sides of said pole pieces and holding them in predetermined spaced relation, a vibratory armature pivotally supported by said plates in operative relation to said pole pieces, a coil associated with said pole pieces and armature, and means for attaching said pole pieces to said magnet.

23. In a telephone receive, a magnet having a pair of limbs, opposite pole pieces projecting inwardly from said limbs substantially in alignment with each other, a support comprising non-magnetic plates secured to said pole pieces at opposite sides thereof, an armature pivotally carried by said support in operative relation to said pole pieces, electromagnetic means for producing vibration of said armature about its pivot, and a diaphragm connected to said armature.

ADOLPH ALEXANDER THOMAS.

CERTIFICATE OF CORRECTION.

Patent No. 1,753,812. Granted April 8, 1930, to

ADOLPH ALEXANDER THOMAS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, line 85, claim 20, strike out the word "centrally"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of June, A. D. 1930.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)