No. 687,996. Patented Dec. 3, 1901.

H. LIEBREICH.

TELEPHONE RECEIVER.

(Application filed Nov. 30, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 4.

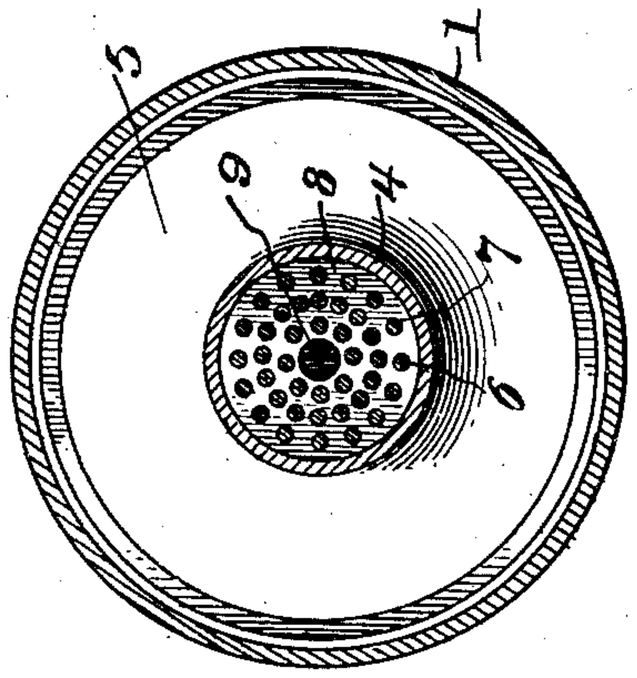


Fig. 1.

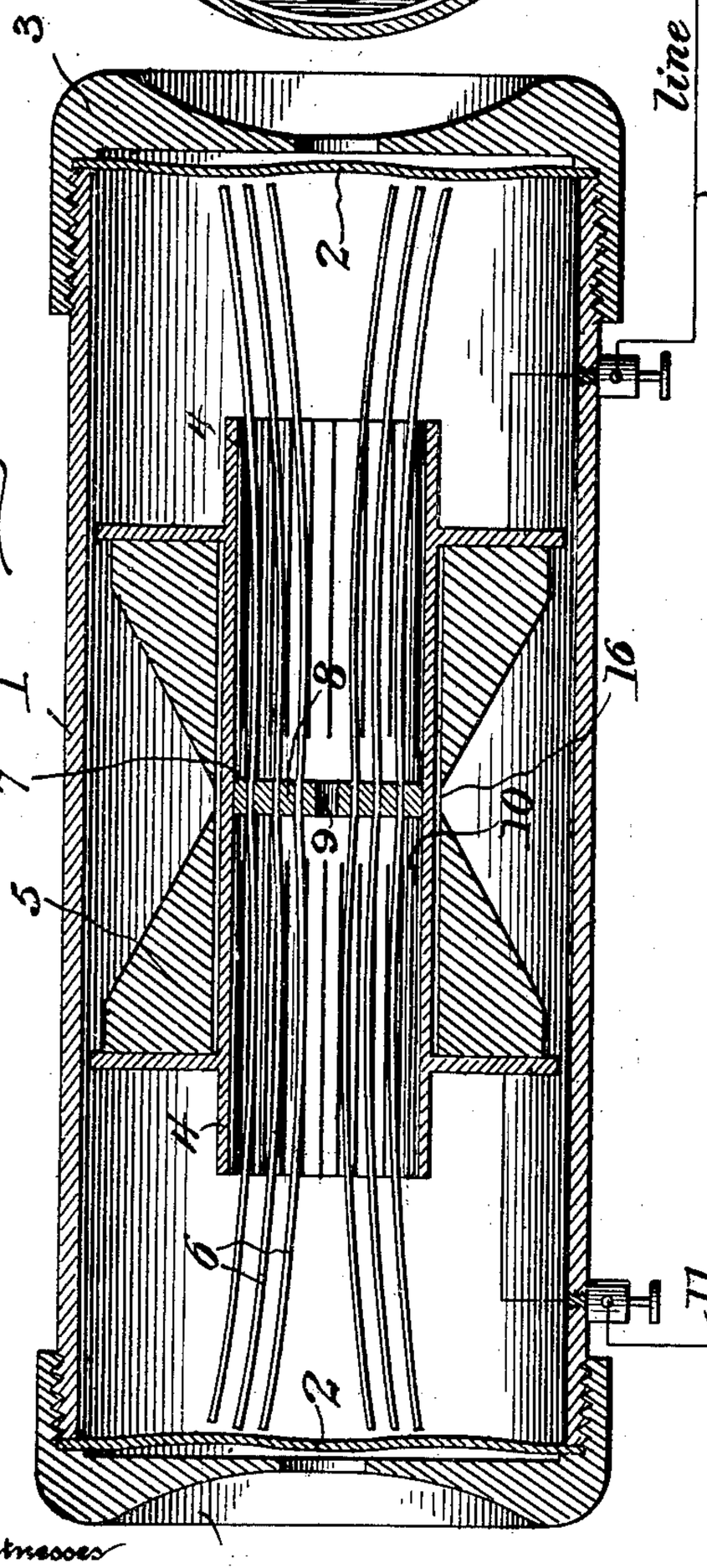
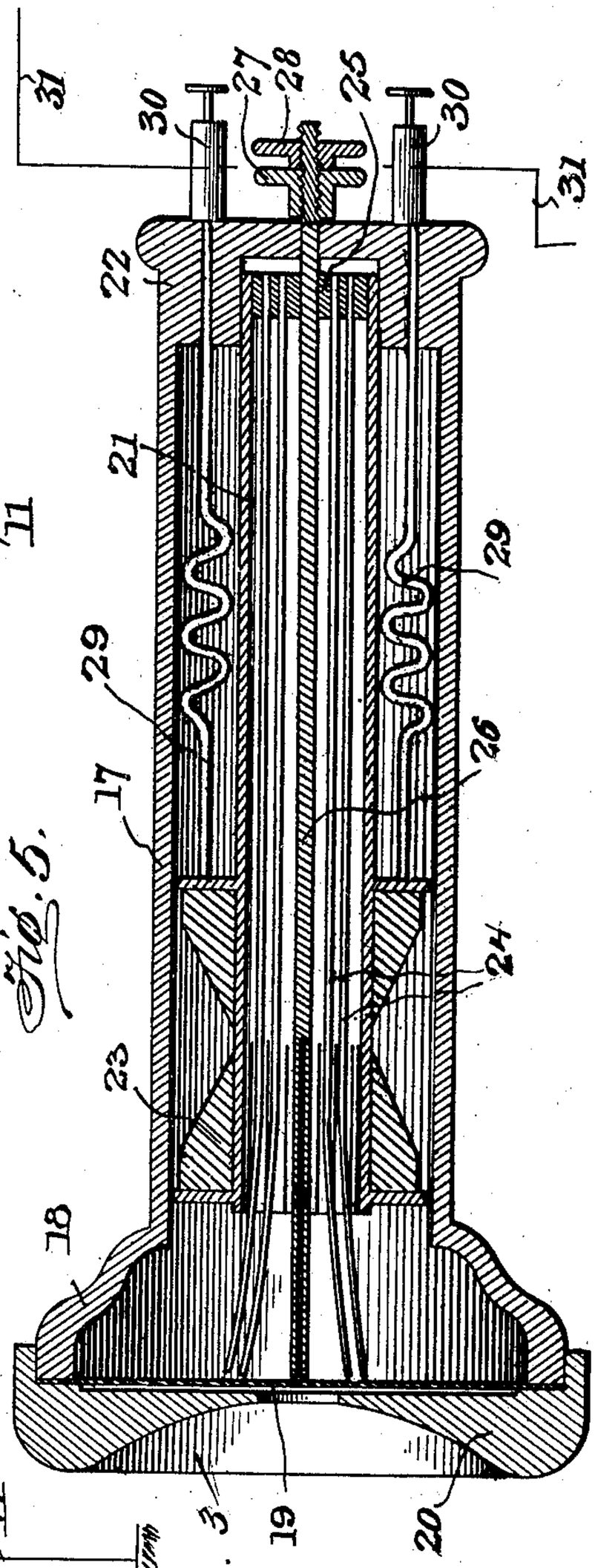


Fig. 5.



Witnesses
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Fig. 8.

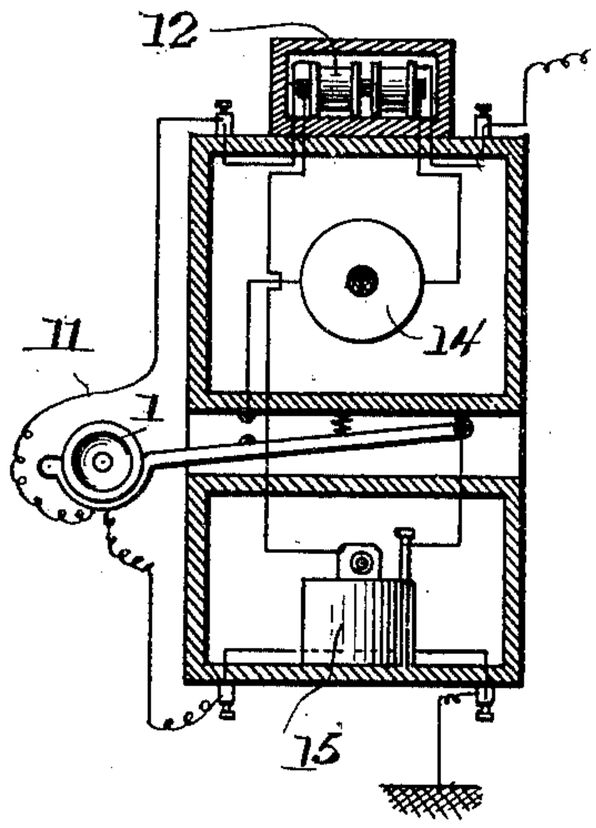


Fig. 2.

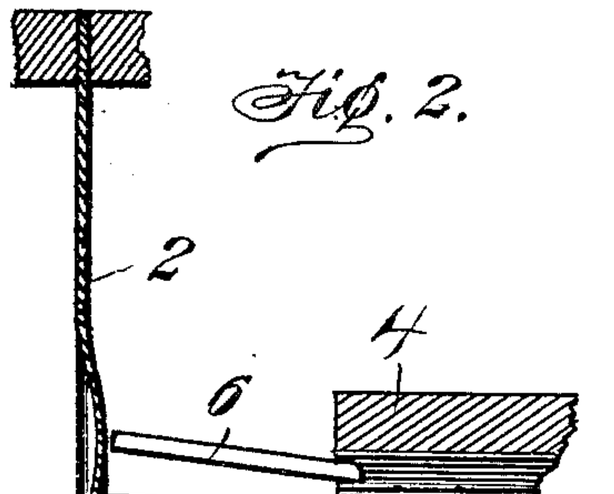


Fig. 3.

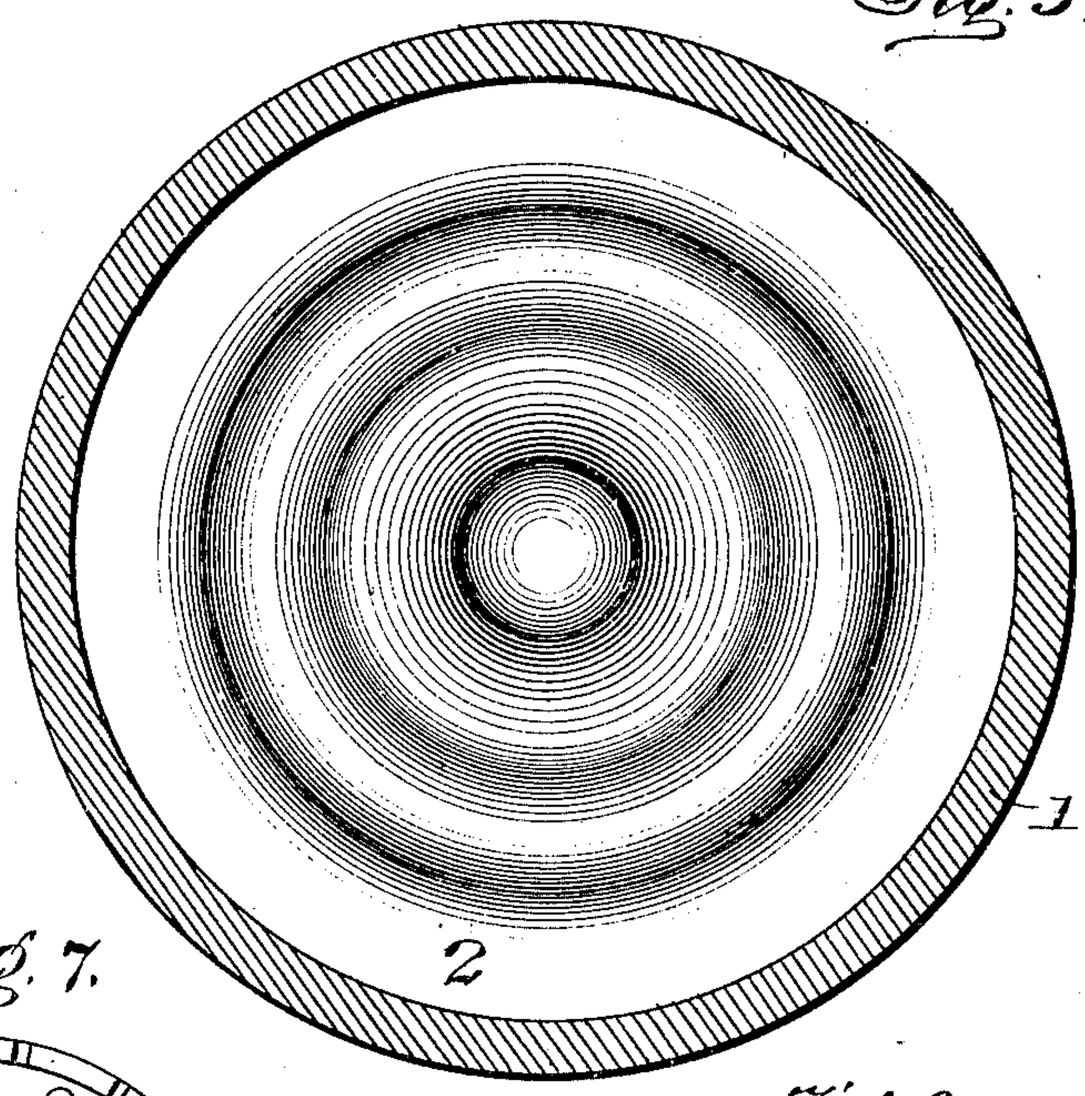


Fig. 7.

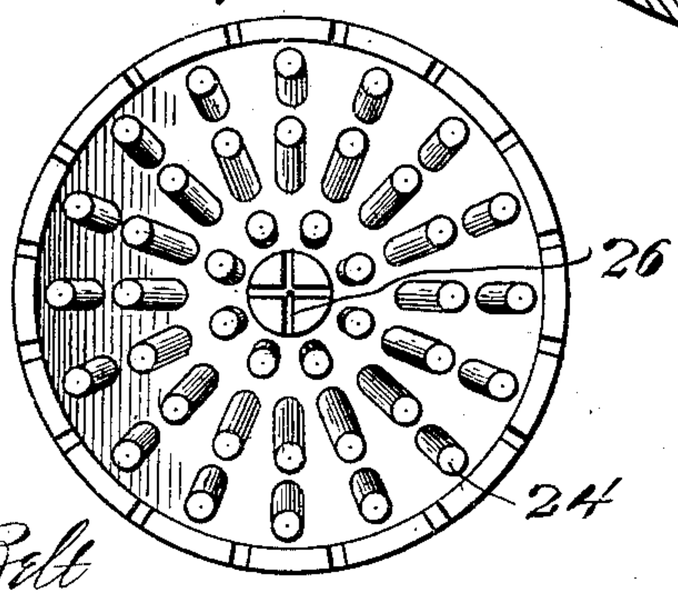
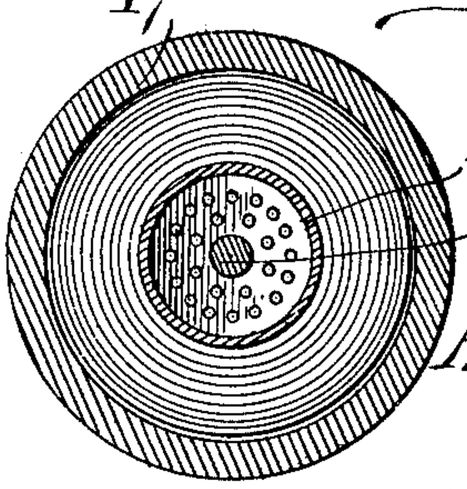


Fig. 6.



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UNITED STATES PATENT OFFICE.

HANS LIEBREICH, OF DETROIT, MICHIGAN.

TELEPHONE-RECEIVER.

SPECIFICATION forming part of Letters Patent No. 687,996, dated December 3, 1901.

Application filed November 30, 1900. Serial No. 38,195. (No model.)

To all whom it may concern:

Be it known that I, HANS LIEBREICH, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Telephone-Receivers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in telephone-receivers, and is particularly adapted for the augmenting or increasing of the power of the tones or impulses received over telephone-lines.

It consists in a receiver having suitable diaphragms, a coil located between them, a core within the said coil carrying a series of permanent magnets, the ends of the said magnets being arranged in suitable proximity to the said diaphragm to actuate the same, and means for connecting the receiver with the line-wires of the telephone.

It further consists in a receiver having one or more diaphragms and an operating-core arranged in suitable proximity to the said diaphragm, said core comprising a split cylinder adapted to be magnetized and demagnetized, a coil surrounding the said cylinder and connected with the line-wires, and a series of magnets mounted within the cylinder for acting directly upon the diaphragm of the receiver.

It further consists in certain other novel constructions, combinations, and arrangements of parts, as will be hereinafter more fully described, illustrated, and claimed.

In the accompanying drawings, Figure 1 represents a longitudinal central section through a receiver embodying the present invention. Fig. 2 is an enlarged sectional detail view of a portion of the said receiver, showing in a diagrammatical manner the action of the receiver-core upon the diaphragm. Fig. 3 is a detail cross-section through the receiver showing the diaphragm in a vibrated condition. Fig. 4 is a detail cross-section through the receiver showing the magnets forming the core thereof and the coils surrounding the same. Fig. 5 is a longitudinal central section through a receiver employing only one diaphragm. Fig. 6 is a cross-section through the same, said section being taken through the neutral point of the coil mounted therein. Fig. 7 is an end elevation of the core and the magnets forming a part of the same. Fig. 8 is a diagrammatical view showing the manner of connecting the receiver with a telephone-line in which a transformer for inducing the efficiency thereof is employed.

My improved receiver is constructed so that it may be used in connection with any ordinary telephone-line; but it is especially efficient when used in connection with a telephone-line employing a device for increasing the power of the impulses sent over the same.

In constructing a receiver of this kind I employ a casing 1, which is a hollow cylinder, to the ends of which I secure flexible diaphragms 2 2 of thin vibrant materials, the said diaphragms being held in position by means of perforated caps 3 3, which may be screwed upon the ends of the cylinder, so as to clamp the said diaphragm in position at their edges, leaving their entire central portions free to vibrate. Within the casing 1 I mount a suitable core which is made up of a cylindrical portion 4, which is surrounded by a coil of wire, as 5. Within the cylinder 4 are arranged a series of magnetic bars, as 6 6, which are preferably secured at a point intermediate of their length, as at 7, within the cylinder 4. For holding these magnets in place I usually employ a block or piece 8, having a series of apertures formed therein adapted to receive the said magnets. The block 8 is also provided with an opening, preferably at the center, as at 9, so as to permit the air to pass freely from one side of the block to the other, according to the action of the diaphragms at the end of the receiver, the said diaphragms being polarized and moving synchronously. This affords an opportunity to secure a column of air between the diaphragms in such a manner as to aid in their acting entirely in unison with each other, and thereby increase the power of the sound which they reproduce. The bars or rods 6 6 are preferably permanent magnets and have their outer free ends located at a point within close proximity of the inner surfaces of the said diaphragms 2 2.

In order to increase the efficiency of the magnets 6 6, I preferably slit the ends of the cylinder 4 to points near the center thereof,

as indicated by the lines 10 10 of Fig. 1. The cylinder-core is preferably formed of soft iron, so that it may be readily magnetized and demagnetized under the action of electrical impulses passed through the coil 5, surrounding the same. By slitting the ends of the cylinder, as just described, a series of electromagnets are formed, which extend parallel with the permanent magnets for a considerable distance and strongly attract the same when the said cylinder is magnetized. The action of the magnets upon the diaphragms forms a very important feature of the present invention, for they cause a warping or vibrating of the said diaphragms in more than a single wave. This action of the magnet upon each diaphragm is clearly illustrated in Fig. 2 of the drawings, where it will be seen that two or more waves or bendings of the diaphragm may be produced by the said magnets. Such concentric waves produced in the diaphragms in response to impulses sent over the telephone-line operate to greatly improve the strength and clearness of the reproductions of the said receiver. From the drawings it will be seen that when the cylinder 4 is magnetized under the action of the coils 5 the permanent magnets 6 6 will be flared outwardly toward the poles of the said cylinder, their outer ends being moved away from the center of the diaphragm and arranged in concentric circles nearer to the periphery thereof, so that the series of waves in the said diaphragm will be correspondingly produced. I find in practice that this construction makes it possible to distinctly reproduce the slightest sound or impulses which may be entered at the transmitter of the telephone-line.

The coil 5 is made up of a winding of wire suitably insulated, and the ends of the coil are connected directly with the line-wires 11 11. A receiver of this kind works admirably with a ground-circuit, so that one of the said wires 11 may be connected directly with the ground. When the receiver is employed upon a line using one of my improved transformers or "magnozines," the said coil 5 is connected with the secondary winding 12 of the said transformer through the line-wire 11, as illustrated in Fig. 8 of the drawings. The primary winding of the said transformer 13 is connected with a receiver 14 and a battery or other source of electrical energy, as 15. The induced currents therefor of said transformer 13 will be passed through the coil 5 for magnetizing or demagnetizing the core of the receiver.

In winding the coil 5 I preferably accomplish it in such a manner as to reduce the resistance of the said core to the line-current without diminishing the power of the coil. This is done, as illustrated in the drawings, by reducing the winding to a minimum at a point opposite to the neutral portion of the coil, as at 16, the winding increasing in thickness toward the ends of the coil opposite the poles thereof, where it attains its full size.

As described thus far the receiver is double-ended and is provided with two diaphragms operating at each end of the same. The invention, however, is applicable to a receiver employing a single diaphragm, as will be seen by reference to Figs. 5, 6, and 7 of the drawings. In this construction a receiver formed of a hollow casing 17 of the usual form is employed, one end of which is enlarged, as at 18, to receive the diaphragm 19, which is held in position by the perforated cap-piece 20. In a receiver of this shape I preferably secure the core to the rear end of the receiver, the cylinder 21 thereof being screwed into an aperture 22, formed in the casing 17. At a point within a suitable distance of the diaphragm 19 I wind a coil 23 around the cylinder 21. The cylinder 21 is made, as before, of soft iron, suitable for being magnetized and demagnetized under the action of the current passing through the coils 23. I also employ a series of permanent magnets or rods 24 24, which are arranged within the cylinder 21 and are secured and spaced at their rear ends within the end of the cylinder 21 by means of a spacing-block 25. The magnets 24 24 extend beyond the open end of the cylinder 21 and to points quite close to the inner surface of the diaphragm 19. In this form of receiver I also preferably employ a central magnet or rod 26, which is adjustably secured in position at the rear of the receiver and extends throughout the core and to a point near the diaphragm 19. The rod 26 is preferably split at its ends to form several reduced end portions, as seen in Fig. 7 of the drawings, the split portion extending opposite to the neutral portion of the coil 23. The rear end of the magnet 26 extends through the plate 25 and through the end of the receiver-casing 17, its projecting end portion being screw-threaded and adapted to receive an adjusting-nut 27 and a clamping-nut 28. By this means the proximity of the magnet ends may be adjusted with relation to the diaphragm 19. I preferably form the block 25 of soft iron, so that the sides of the pipe 21 and the magnets 24 and 26 are made into horseshoe-magnets under the influence of the coil 23. The coil 23 is connected by means of wires 29 29 with binding-posts 30 30, which receive and secure in place the ends of the line-wires 31 31. The action of the magnets upon the diaphragm 19, under the influence of the coil 23, will be quite similar to that heretofore described with respect to the diaphragms 2 2. The use of the central magnet 26, however, will tend to draw to one side the center of the diaphragm and produce a still greater number of concentric waves in the diaphragm.

In using receivers of this kind I find that they are very sensitive to the impulses received over the telephone-line and that they will reproduce the slightest sound or impulses taken in at the transmitter and will augment them, so as to be strong and distinct. The

construction of the receiver is quite simple and can be incorporated in any telephone-line and is not likely to get out of order easily.

Having now described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A receiver for telephones, comprising a casing, one or more diaphragms mounted therein, a core for operating the diaphragms comprising a series of magnets grouped about the axis of the receiver and capable of flaring outwardly at their ends and a coil surrounding the same for engaging them, the coil being connected with the line-wires, the structure being such that the magnets will produce a series of vibrations in the diaphragm, according to the impulses received in the coil, substantially as described.

2. A receiver for telephones, comprising a casing, diaphragms mounted therein, a core interposed between the diaphragms comprising a series of magnets grouped about the axis of the receiver and having their ends arranged in close proximity to the said diaphragms and free to bend in any direction, a coil for varying the position of said magnets and their action upon the diaphragms, said coil being connected with the line-wires of the telephone, substantially as described.

3. A telephone-receiver having two diaphragms arranged at each end thereof, a coil interposed between the diaphragms, a core mounted in the coil and consisting of a cylinder adapted to be magnetized and demagnetized, a series of magnets adapted to be mounted in the cylinder and having their ends arranged close to the diaphragms, means for holding the magnets in position within the coil, whereby their outer ends are free to vibrate, and means for passing a current through the coil for varying the action of the magnet on the diaphragms, substantially as described.

4. A receiver for telephones, comprising a casing, diaphragms secured at each end thereof, a core located between the diaphragms comprising a series of magnets or rods extending to within a short distance of the diaphragms, a block for holding the same at their central point, a cylinder of soft iron around the magnets and holding the block in position the said cylinder being slotted at its ends to form a series of projections parallel with the magnets and adapted to be magnetized or demagnetized, a coil surrounding the said cylinder and adapted to receive the current from the line-wire, the said block for supporting the magnets having an aperture whereby a column of air may be maintained between the diaphragms for causing them to act in unison, substantially as described.

5. A telephone-receiver having a diaphragm, means for magnetically attracting the diaphragm in concentric waves, comprising a series of magnets having free movable ends so that they may be spread out over a greater or less portion of the diaphragm according to the strength of the current to which they are subjected, and means for increasing or diminishing the magnetic force of the same, substantially as described.

6. A telephone-receiver comprising a casing, one or more diaphragms mounted therein, means for vibrating the diaphragms in concentric circles, comprising a series of magnets capable of vibration at their ends so as to cover a large or small portion of the diaphragm according to the strength of the current to which they are subjected, means for varying the position of the magnets with respect to the diaphragm and thereby altering the shape of the vibrations produced in the diaphragms, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

HANS LIEBREICH.

Witnesses:

JOHN L. FLETCHER,

CASSELL SEVERANCE.