(No Model.) 2 Sheets—Sheet 1.

A. T. COLLIER.

TELEPHONE RECEIVER.

No. 474,214. Patented May 3, 1892.

Fig. 1.

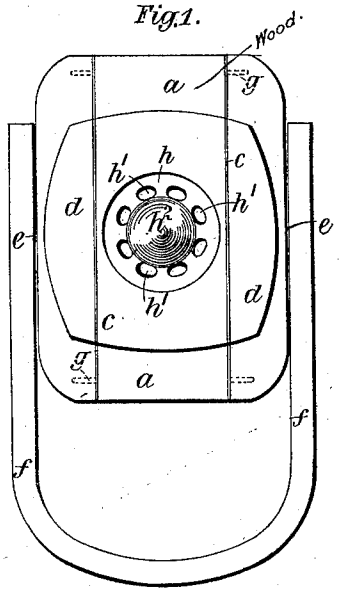


Fig. 2.

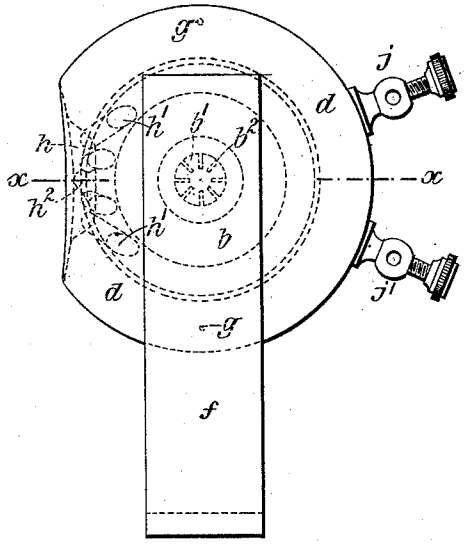


Fig. 4.

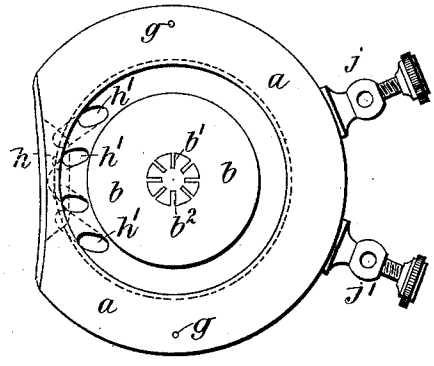
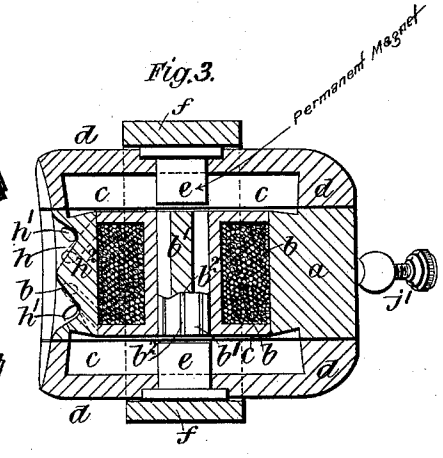


Fig. 3.



Witnesses:—
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Inventor:
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By James L. Norris.
Attorney.

(No Model.) 2 Sheets—Sheet 2.

A. T. COLLIER.

TELEPHONE RECEIVER.

No. 474,214. Patented May 3, 1892.

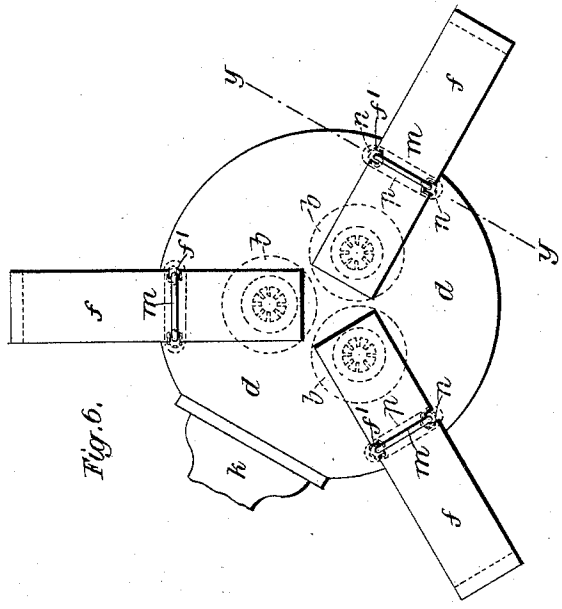

Fig. 6.

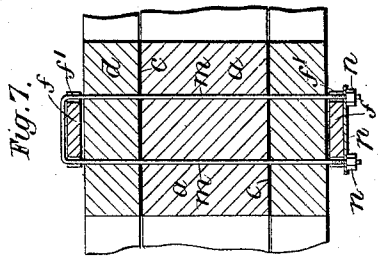

Fig. 7.

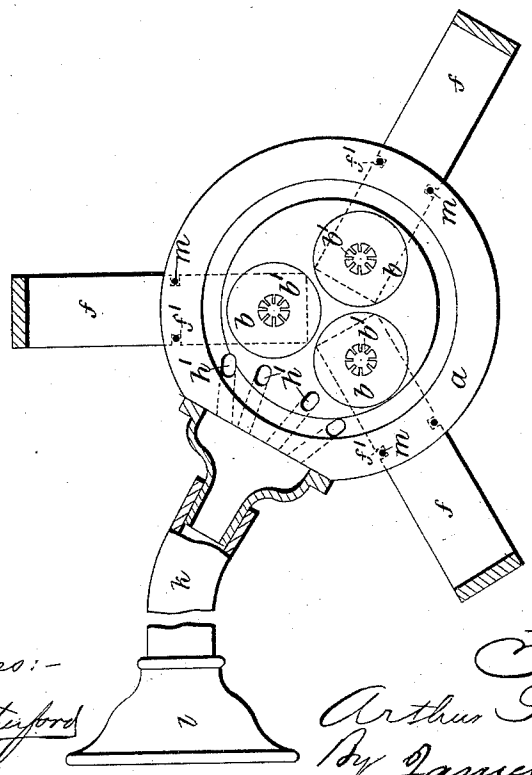

Fig. 5.

Witnesses:-
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UNITED STATES PATENT OFFICE.

ARTHUR THOMAS COLLIER, OF CATERHAM VALLEY, ENGLAND.

TELEPHONE-RECEIVER.

SPECIFICATION forming part of Letters Patent No. 474,214, dated May 3, 1892.

Application filed June 30, 1891. Serial No. 398,006. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR THOMAS COLLIER, gentleman, a subject of the Queen of Great Britain, and a resident of Caterham Valley, Surrey, England, have invented certain new and useful Improvements in Telephone Receivers Usable, also, as Transmitters, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to telephone-receivers which are also useful as transmitters.

The object of my said invention is to increase the power of magnetic telephones so that messages can be transmitted over a longer distance and can be heard more distinctly than by the instruments of this kind or class hitherto employed. I accomplish the desired result by my invention in such a manner that when a message is spoken into a transmitter (whether constructed as herein described or of any other suitable construction) connected in the usual manner with my improved telephone sound-waves of great power will be caused to impinge on the tympan of the ear of the person using the said telephone.

An important feature of my said invention is the construction of the telephone with two diaphragms or tympans, each of which is placed between two magnet-poles or between two groups of magnet-poles, and with an ear-piece or mouth-piece, which is connected with the air chambers or spaces between the said diaphragms or tympans and the adjacent ends of the inner magnet or magnets.

For the purpose of my invention I arrange in suitable proximity to each of the poles of an electro-magnet which is actuated by the line-current a diaphragm or tympan and provide a permanent magnet, which is so arranged that the two diaphragms or tympans are in suitable proximity to the poles thereof, respectively, and each of the said diaphragms or tympans is situated between one of these poles and the adjacent pole of the said electro-magnet. The permanent magnet may be replaced by an electro-magnet actuated by a local battery. By the construction of the telephone in this manner I greatly increase the efficiency of the same. Moreover, I am enabled to make the apparatus very strong and compact, and to so construct it that the permanent magnet will conveniently serve as the handle of the apparatus and also as the means for suspending it from a hook or the like when it is not in use.

My said invention, moreover, comprises other improvements hereinafter set forth.

In the accompanying drawings I have shown how my said invention may be conveniently and advantageously carried into practice.

Figure 1 is a front elevation, and Fig. 2 is a side elevation, of one form of my improved telephone. Fig. 3 is a horizontal section on the line *x x*, Fig. 2, and Fig. 4 is also a side elevation of the said telephone, some of the parts being removed. Fig. 5 is a sectional side elevation, some of the parts being removed, showing another form or modification of my improved telephone. Fig. 6 is a side elevation of this telephone, and Fig. 7 is a section on the line *y y*, Fig. 6, showing details of construction.

Like letters indicate corresponding parts throughout the drawings.

a is a hollow cylinder or annular disk of wood, vulcanite, or other suitable material, in the center of which is secured an electro-magnet *b*. On each side of the said cylinder or disk *a* is arranged a diaphragm or tympan *c*, which is firmly held around its edge between an annular projection on the said disk and a corresponding projection on a case or cover *d*. In the center of each of the cases or covers *d* is fitted a flanged pole-piece *e*. The whole of the parts are securely held together by means of a horseshoe permanent magnet *f*, so arranged that the poles thereof bear firmly against the flanged ends of the pole-pieces *e*. This magnet is preferably secured to the covers *d* by means of screws or in any other convenient manner. The diaphragms or tympans *c* and the covers *d* are preferably retained in place upon the disk *a* by means of pins or studs *g*, which extend through holes in the diaphragm and into corresponding holes in the cover.

When each of the tympans is arranged between two magnet-poles, as above described, the effect produced by the magnetic variations or fluctuations is much more powerful than when the tympan is simply arranged in proximity to a magnet-pole situated on one

side thereof, as in the Bell telephones, hitherto employed.

The cylinder or disk *a* has formed therein a recess or cavity *h*, which serves either as an ear-piece or as a mouthpiece, and which is in communication, through apertures or passages *h'* in the said cylinder or disk *a*, with the spaces between the tympans *c* and the ends of the said cylinder or disk and of the electro-magnet *b*, inclosed therein. I prefer to make the said ear-piece or mouth-piece with a central cone h^2 for the purpose of more effectually directing the sound-waves to the ear or from the mouth, as the case may be. By forming the ear-piece or mouthpiece in the said cylinder or disk and connecting it with the spaces between the diaphragms or tympans, as above described, I provide for very efficiently utilizing, in addition to the sound-waves produced by both tympans, the vibrations or molecular movements set up in the core and coil of the electro-magnet. Moreover, the sound-waves produced in the said spaces by the vibrations of the tympans will be conducted directly to and concentrated in the ear-piece *h*, and the sound-waves produced by the vibrations of the tympans in the spaces between the latter and the covers *d* will also be transmitted to the ear of the person using the telephone through the material of the said covers and of the cylinder or disk *a*. The cylinder or disk *a* and the covers *d* form a box or case in which are inclosed the two tympans and the electro-magnet arranged between the same.

If deemed desirable, a suitable tube may be connected with the spaces between the tympans *c* and the covers *d*, so that while a person using the telephone holds the ear-piece *h* to one ear he can hold the said tube to the other ear.

I find it advantageous to make the soft-iron core *b'* of the electro-magnet *b* of larger diameter than has hitherto been found desirable, and to form in the said core series of longitudinal slots b^2, extending from end to end thereof, as shown, the efficiency of this core of increased size depending upon the slotted formation thereof. By making the said core in this manner I provide a comparatively large mass of soft iron, which is nevertheless very sensitive to magnetic variations or fluctuations.

The two ends of the wire forming the coil of the magnet *b* are connected in any convenient manner with the terminals *j j'*.

The tympans may be formed, as usual, of the iron plate known as "ferrotype" or any other suitable iron plate, or they may be of pine wood turned from the solid with a flange all around to give rigidity thereto, a piece of soft iron being secured to the pine-wood tympan at the center thereof; or the said tympans may be formed of any other suitable substances.

Although the form of my instrument illustrated in Figs. 1 to 4 of the accompanying drawings is very convenient and advantageous, yet it is obvious that I can, if desired, somewhat modify the construction thereof without departing from the nature of my said invention. For instance, the permanent magnet may be inclosed, together with the electro-magnet and tympans, within a suitable case and the covers *d* be dispensed with. The electro-magnet can, if desired, be made with a core of any other suitable form. Instead of the permanent magnet I can, as above stated, employ another electro-magnet actuated by a local battery. I can, moreover, make my telephone with more than one ear-piece or mouthpiece connected with the space or spaces between the tympans, and I can, if desired, employ more than one pair of magnets.

In Figs. 5, 6, and 7 I have shown a modification of my improved telephone, wherein I use three electro-magnets *b* and a corresponding number of permanent magnets *f*. The telephone shown in these figures is provided with a tube *k*, furnished with an ear-piece or mouthpiece *l*. In these figures, moreover, I have illustrated a convenient mode of securing the parts of the instrument together, which is also applicable to other forms of my improved instrument, such, for example, as that shown in Figs. 1 to 4. For this purpose I form in the magnets *f* slots or notches *f'* and I pass through these slots or notches and through holes in the covers *d* and cylinder or disk *a* suitable stirrups or straps *m*, formed of pieces of wire bent to the required shape and screw-threaded at their extremities to receive nuts *n*, whereby they are firmly secured in place, a metal plate or bar *p* being placed between the said nuts and the adjacent surface of the corresponding magnet *f*. By these means the whole of the parts are rigidly fastened together and I am enabled to dispense with the pins or studs *g*, hereinbefore described.

It is obvious that I can, if desired, employ a group of two or more electro-magnets in combination with a single permanent magnet of suitable dimensions.

The current in the line-wire which actuates the electro-magnet or group of electro-magnets may be alternate, such as is produced by an electro-magnetic transmitter or a carbon transmitter and induction-coil, or it may be of varying strength but constant direction, such as is produced by a carbon transmitter or microphone acting directly.

The poles of the electro-magnet and of the permanent magnet should be situated at such relative distances from the diaphragms, respectively, that the superior attraction is exerted by the electro-magnet. The poles or pole-pieces of the permanent magnet must not have any coils upon them through which the line-current passes, as that would seriously interfere with the action of the instrument and operate to neutralize its advantages.

The mouthpiece may, if desired, be connected with the spaces outside the diaphragm; but I prefer the arrangement above described—viz., wherein it is connected with the space between the diaphragms.

What I claim is—

1. A telephone provided with two diaphragms or tympans, each of which is arranged between the poles of two magnets or between the poles of two groups of magnets, one of the magnets or groups of magnets being actuated by the current in the line-wire, the other being independent of such line-current and provided, also, with one or more ear-pieces or mouthpieces connected with the space or spaces between the tympans, substantially as herein described.

2. In a telephone, the combination, with a straight electro-magnet having its coil in the line-circuit, of an independent magnet having its respective poles opposed to the poles of the electro-magnet, and two diaphragms, each of which is interposed between one of the pairs of opposed magnet-poles, substantially as described.

3. A telephone comprising two diaphragms or tympans, an electro-magnet actuated by a current in the line-wire, arranged between the said tympans in a box or case provided with an ear-piece or mouthpiece, and a second magnet the poles or pole-pieces of which are in suitable proximity to the said tympans, substantially as herein described.

4. The combination of a cylinder or disk *a*, provided with an ear-piece *h*, communicating with the spaces at the ends of the said cylinder or disk, an electro-magnet *b*, extending longitudinally through the said cylinder or disk, and diaphragms or tympans *c*, secured one to each end of the said cylinder or disk, substantially as and for the purposes above specified.

5. The combination of a cylinder or disk *a*, provided with an ear-piece *h*, communicating with the spaces at the ends of said cylinder or disk, an electro-magnet *b*, extending longitudinally through the said cylinder or disk, diaphragms or tympans *c*, secured one to each end of the said cylinder or disk, and a permanent magnet *f*, the poles of which are exterior to the said diaphragms or tympans and opposite the poles of the said electro-magnet, substantially as and for the purposes above specified.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ARTHUR THOMAS COLLIER.

Witnesses:
ALF. WALTER TAYLER,
P. DEVIN.