(No Model.)

L. DE LOCHT-LABYE.

TELEPHONE.

No. 315,421. Patented Apr. 7, 1885.

FIG. 1.

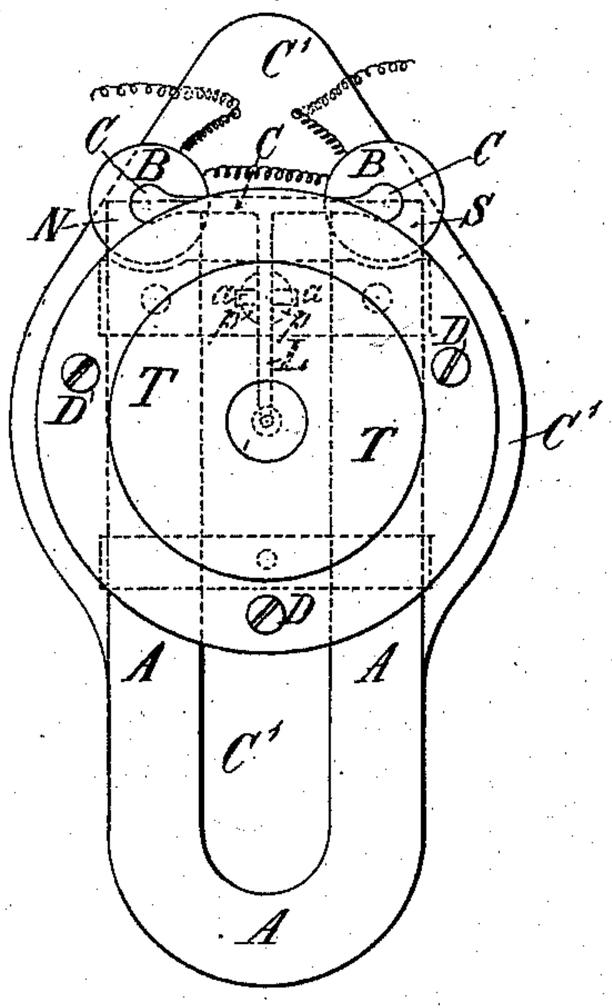


FIG. 2.

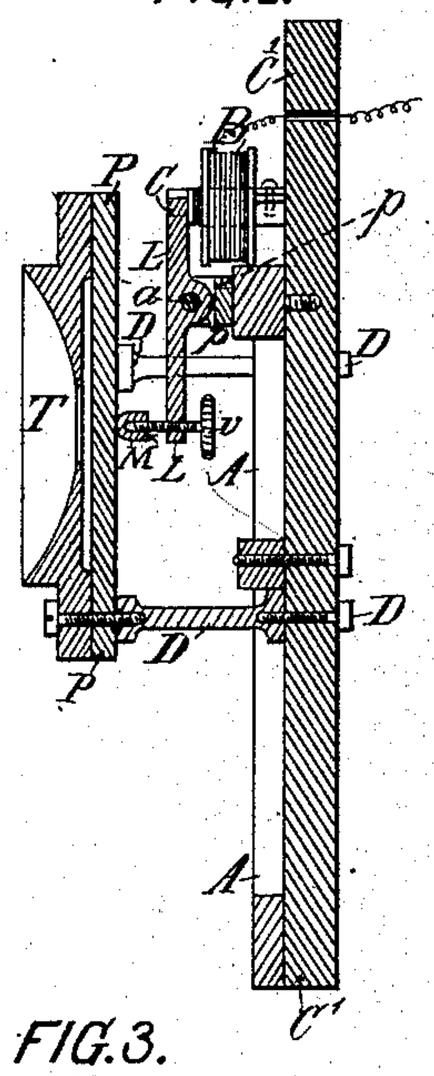


FIG. 4.

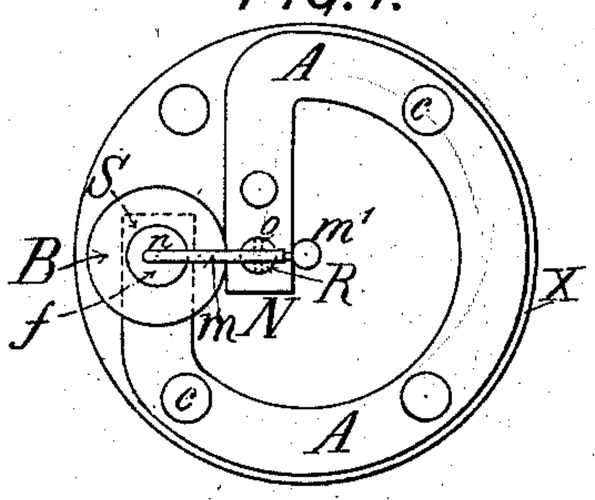


FIG. 3.

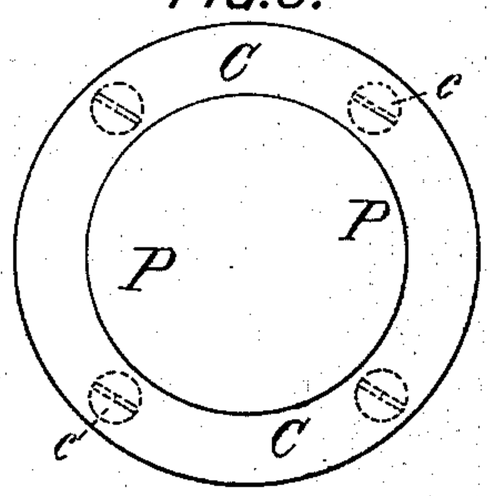


FIG. 5.

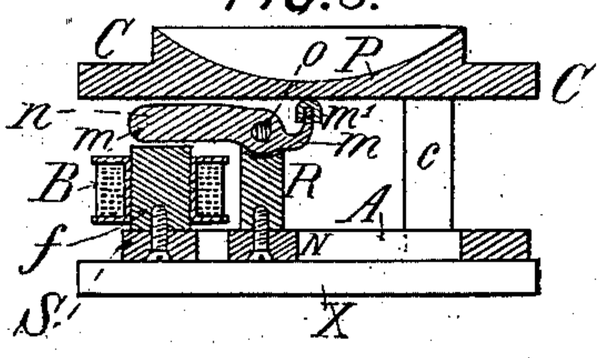


FIG. 6.

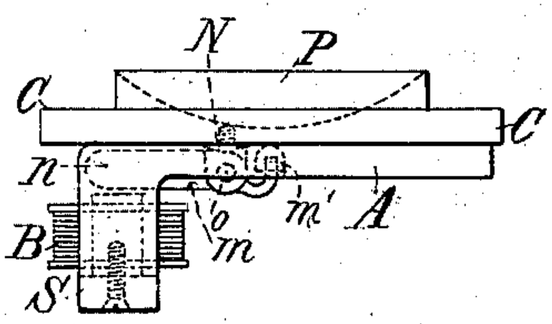
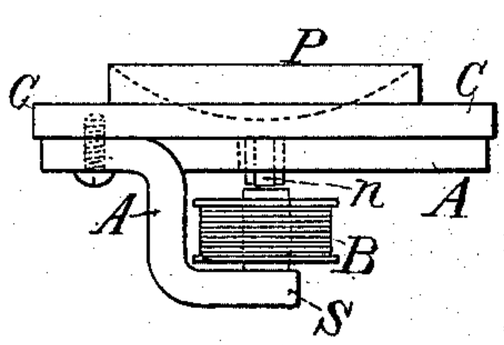


FIG. 7.



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UNITED STATES PATENT OFFICE.

LÉON DE LOCHT-LABYE, OF LONDON, COUNTY OF MIDDLESEX, ENGLAND.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 315,421, dated April 7, 1885.

Application filed November 15, 1883. (No model.) Patented in England October 11, 1882, No. 4,832, and in Austria June 9, 1883, No. 30/930.

To all whom it may concern:

Be it known that I, LÉON DE LOCHT-LABYE, a subject of the King of Belgium, but at present residing in Langham Street, Portland Place, London, in the county of Middlesex, England, have invented certain new and useful Improvements in Telephones, (for which I have received Letters Patent in Great Britain, No. 4,832, dated October 11, 1882, and in Austria, No. 30,930, dated June 9, 1883;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a telephone in which the transmission and reproduction of sounds and of articulate speech are effected by producing shocks from or to a rigid obstacle, and consequently instantaneous movements of an armature opposite a permanent or electro magnet in lieu of by the inflections of a thin disk or tympan, as used in telephones of what is known as the "Bell type."

In carrying out the invention I employ, in combination with a permanent magnet or electro-magnet provided at one or at both its poles with a coil of insulated wire, a rigid armature of steel or soft iron, freely oscillating around an axis and ending in a hammer, which bears on a rigid obstacle, hereinafter referred to also as the "rigid body," as contradistinguished from the thin flexible diaphragm of the ordinary telephone. The coil or coils on the magnet is or are interposed in the telephonic circuit.

The apparatus is applicable both as a transmitter and as a receiver.

In using the apparatus as a receiver the telephonic currents circulating in the coils cause the armature to be alternately attracted and repelled. By reason of the reaction of the rigid obstacle, against which the armature-lever rests, the repulsion alone is effective in producing the first movement of the armature. The latter in moving away from the pole momentarily separates the hammer at the end of the lever from the rigid obstacle. This repulsion is succeeded by the attraction of the armature caused by the following current, and the armature is then pulled back to its original position, and tends to pass beyond this position by reason of the attraction and its own *vis viva* or momentum, but it is stopped in this direction by the rigid obstacle against which the hammer strikes. The intensity of the blow or shock consequently results from the combined effect of these two actions, and is in direct ratio to the electro-magnetic forces which produce the repulsion and attraction of the armature. The number of shocks is equal to the number of electrical changes produced in the telephonic circuit. The sounds or words transmitted are by means of this apparatus reproduced in all the component vibrations, and the telephonic transmission is clear and distinct. The alternative movements of the armature resulting from the action on the magnet of the telephonic currents circulating in the coils produce corresponding oscillations of the lever and synchronous blows of the hammer upon the rigid obstacle, and inversely when the instrument is employed as a transmitter, the functions of the apparatus being reversible, the emission of sounds or words upon the rigid obstacle produces synchronous blows upon the hammer, and by the intervention of the lever causes corresponding oscillations of the armature before the magnetic poles. These oscillations of the armature generate in the coils electric currents which can be transmitted to a distant station.

The lever employed may be of the first, second, or third order—that is to say, its fulcrum or axis of oscillation may be situated either between or beyond the points at which the magnetic attraction or repulsion of the armature and the reaction of the rigid obstacle are applied. The relative lengths of the lever-arms and their actual dimensions vary according to circumstances.

Words are found to be transmitted with more clearness and distinctness when the rigid obstacle or the hammer or both are composed of dead or non-resonant materials—that is to say, materials exempt from molecular vibrations—but other materials may be employed if found desirable. The rigid body is prefer-

ably composed of cork, india-rubber, ebonite, wood, or other analogous material, and is of such thickness as to render it rigid and not liable to bend or yield under the pressure of the armature-lever. The same effect may be obtained by cementing or otherwise applying to the rigid obstacle at the "shocked point"—namely, the point where the hammer strikes—a small, thin, soft piece of leather, cork, or the like.

The armature should be suspended as near as possible to the pole or poles of the magnet without absolutely coming in actual contact with the latter in order that the maximum of magnetic effect may be produced. The position of the armature may be adjusted by means of a screw or nut, which serves to shift the fulcrum of the lever, or by altering the position of the poles of the magnet relatively to the armature by analogous means, or by moving the rigid body, or by screwing or unscrewing the hammer upon the lever so as to adjust its position thereon.

It is not necessary to inclose the parts in a case acting as a sounding-box, as the rigid body may be brought directly in contact with the ear by a suitable mouth-piece or ear-piece. By thus dispensing with the sounding-box objectionable reverberations and echoes, which are common to many telephones, are obviated.

And in order that the said invention may be fully understood I shall now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on the annexed drawings, the same letters of reference indicating corresponding parts in all the corresponding figures.

Figure 1 of the accompanying drawings is a plan of a telephone constructed according to this invention, and Fig. 2 is a vertical section of the same.

A is a horseshoe-magnet provided at its poles N S with soft-iron prolongations or extensions, on which are placed coils B B of insulated copper wire. This magnet is fixed immovably to a frame, C′, which serves as a support to the whole apparatus. In front of and in close proximity to the poles N S of the magnet is an armature, C, consisting of a thick inflexible bar of soft iron or magnetized steel. This bar forms part of a rigid lever, L, moving freely on a fixed axis, *a a*, carried on a support, *p p*, of copper, brass, or other suitable material. It will thus be seen that the armature-lever is free, and consequently is in itself in no way of the nature of a flexible disk. It is only fixed to the support by its axis, and is not connected with any membrane or other organ. It terminates in a small cap or hammer, M, of cork, rubber, wood, metal, or other suitable material, fixed to the extremity of a regulating-screw, *v*. This hammer in its normal position rests upon the rigid obstacle or rigid body before referred to, consisting of a thick, rigid inflexible piece, P, of wood, glass, ebonite, or other suitable material of any shape whatever, but which, for the sake of symmetry, is assumed to be cylindrical in the apparatus shown in the drawings, the mouth or ear piece T of the telephone being fitted to the said piece P.

The position of the armature-lever is determined by the magnetic attraction of the poles of the magnet, the effect of which is counterbalanced by the reaction of the rigid obstacle supporting the hammer at the end of the lever. By the aid of the screw *v*, which carries this hammer, the distance between the poles of the magnet and the armature may be regulated with facility, so as to obtain the maximum telephonic effect.

The mouth or ear piece and the rigid obstacle P are connected with the frame C′ C′ by means of three pillars, D D.

In the example illustrated in the drawings, the usual inclosing box or case is omitted, it not being necessary to employ one in carrying out my invention, as the rigid body may be brought directly in contact with the mouth or ear by a suitable mouth-piece or ear-piece. By thus dispensing with the sounding-box objectionable reverberations and echoes, which are common to many telephones, are obviated.

If desired, one of the two ends of the armature may be in contact with the magnetic pole opposite it, the other end being separated from the other pole.

Figs. 3, 4, and 5 illustrate the application of the invention with a different form of magnet and rigid body. Fig. 3 is a front view or plan showing the exterior of the apparatus, and Fig. 4 is a view showing the parts at the under side or rear of the rigid body. Fig. 5 is a vertical section of the apparatus.

The magnet A is so formed that its poles are situated at different distances from the center upon the same diametrical line, as shown at N and S, Figs. 4 and 5. The pole N is provided with a pillar, R, of soft iron, the extremity of which is forked to receive an armature-lever, *m*, which oscillates on a pin, *o*, passed through the two legs of the fork. The pole S of the magnet carries a coil, B, of insulated copper wire upon a cylinder, *f*, of soft iron, fixed to said pole.

The armature-lever *m*, consisting of a small piece of sheet-iron suspended edgewise, so as to present the requisite stiffness or rigidity, oscillates on the axis *o*, and presents at *n* the same magnetic polarity as the pole N of the magnet upon which it oscillates, and is consequently powerfully attracted by the pole S of the said magnet. A small metallic hammer, *m′*, is screwed to the extremity of the armature-lever, so as to admit of the adjustment of the distance between the tail of the said armature-lever and the pole S.

The rigid body C is composed of a circular piece of wood having a spherical hollow, P, formed in its front side and acting as a mouth-piece or ear-piece. This piece of wood is con-

nected by pillars *c* of the same material or of metal to the base-plate X, which carries the magnet and bobbin. This arrangement simplifies the construction of the apparatus.

The magnet A may be fixed directly to the edge of the piece of wood C and the pole N, which carries the axis of oscillation of the armature, be likewise directly connected to this piece, as shown in Figs. 6 and 7, which represent side views of the apparatus taken at right angles to each other. The magnet is bent outward at the extremity connected to the coil, so as to form a sufficient space between the extremity and the rigid piece to receive the cylinder of soft iron that carries the bobbin or coil B, and to allow sufficient play to the end *n* of the armature-lever. The rigid body thus receives at two adjacent points the vibrations transmitted through the hammer *m'* at the end of the armature-lever and through the axis *o* of the lever at its point of support or oscillation, which is directly connected to the rigid piece, and the sound transmitted to the ear being produced by the sum of these two actions is consequently augmented.

I may also connect with great advantage the pillar carrying the axis of oscillation of the lever (when such pillar is made of soft iron) to the magnet at the same side and near to the pole carrying the coil in such a manner that the two soft-iron prolongations have at their ends the same magnetic polarity, but at different rates. The oscillating armature receives at its end opposite or facing the coil a dissimilar polarity; but the whole is, from a magnetic point of view, in a position of unstable equilibrium, which is to be altered by the most minute changes transmitted in the telephonic circuit.

These telephones may be constituted with a number of magnets arranged radially or side by side or otherwise, each of such magnets being provided with an armature-lever, which strikes the same rigid surface so as to multiply the intensity of each compound blow by the number of the component blows, and consequently strengthen the sound transmitted.

It is evident that the form of the magnet and the mode of fixing the axis of the armature, the form, materials, and dimensions and mode of fixing of the lever and of the intervening rigid body, which transmits the sonorous vibrations to the ear, and the arrangement of the whole apparatus may be varied without affecting the principle of the invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The hereinbefore-described improvement in telephones, consisting in the combination of a permanent magnet or electro-magnet provided at its pole or poles with a coil or coils of copper wire interposed in the telephonic circuit, and an armature of soft iron or magnetized steel communicating vibrations by means of a rigid lever to or from a rigid body, which constitutes the medium for the transmission and reception of the sonorous vibrations, the whole being arranged and operating substantially as hereinbefore described, and illustrated in the accompanying drawings.

2. In a telephone, the combination of an armature-lever, a hammer screwed upon the end of the said lever so as to be capable of adjustment, and the body with which said hammer coacts, substantially as hereinbefore described, and illustrated in the accompanying drawings.

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

LÉON DE LOCHT-LABYE.

Witnesses:

THOMAS JOHN HANDFORD,

ALFRED MAXWELL,

Both of 42 *Southampton Buildings, London.*