(No Model.)

C. CLAMOND.

MICRO TELEPHONE.

No. 372,455. Patented Nov. 1, 1887.

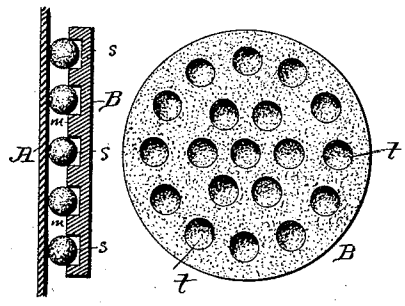

Fig. 1. Fig. 2.

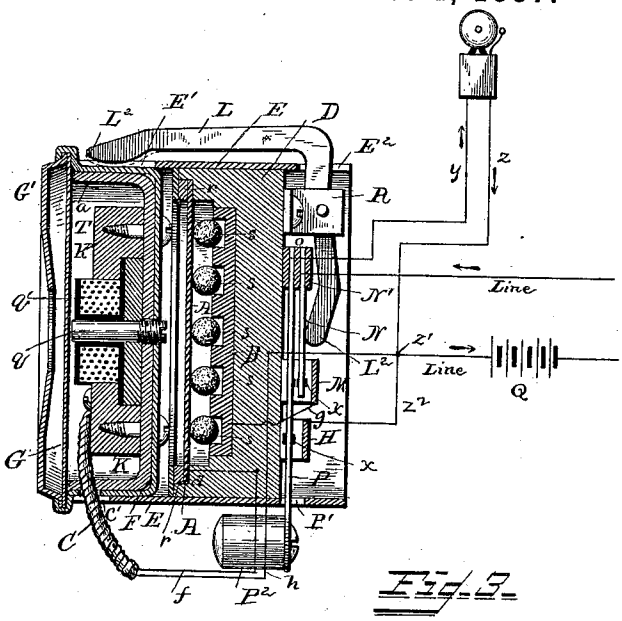

Fig. 3.

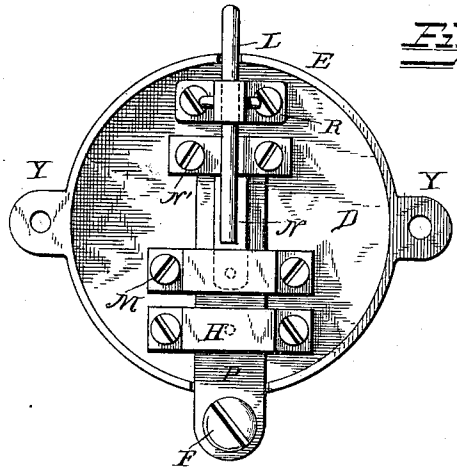

Fig. 4.

Witnesses

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CHARLES CLAMOND, OF PARIS, FRANCE.

MICROTELEPHONE.

SPECIFICATION forming part of Letters Patent No. 372,455, dated November 1, 1887.

Application filed September 22, 1887. Serial No. 250,429. (No model.) Patented in France August 14, 1886, No. 177,967, and in Belgium February 23, 1887, No. 76,460.

To all whom it may concern:

Be it known that I, CHARLES CLAMOND, a citizen of the Republic of France, have invented certain new and useful Improvements in Microtelephones, (patented in France, August 14, 1886, No. 177,967, and in Belgium February 23, 1887, No. 76,460,) of which the following is a specification.

Microtelephonic-station apparatus heretofore constructed consisted, as a rule, of a microphonic transmitter, an induction-coil, a magneto-call, a bell, a magneto-receiver, and a switch for cutting the bell out of circuit when the apparatus was used for oral intercommunication, and for including the bell and cutting the transmitter and receiver out of circuit when the apparatus was not in use. Moreover, in modern instruments, the transmitter is generally placed in a local circuit, and each station is therefore provided with a local battery. The assemblage of all these parts in one complex apparatus gives to the whole a strange and awkward appearance. It is also necessarily voluminous, and is for these reasons an objectionable feature in an elegantly furnished dwelling. Attempts to reduce the size of the apparatus by the omission of the induction coil and otherwise usually resulted in a weakening of the transmitted sounds, and the accumulation and crowding of numerous parts within a small compass made it difficult to keep the microphone in adjustment.

It is the object of my invention to overcome these objections and difficulties by constructing a microtelephonic-station apparatus of small compass, comprising a microphone in the line-circuit, which always retains its original condition, and therefore requires no adjustment, and which, without the use of an induction-coil, will transmit a large volume of sound; a magneto-receiver of such form and size as to fit into the mouth-piece of the microphone, so that it may be safely placed within the same and out of the way; a suitable switch partly covered by the microphone, but easy of access for inspection and repair, and a call-bell, which may be placed in any part of the room and need not be visible at all.

The essential parts of my station apparatus are thus encompassed within a small space, and the whole may appear to the eye as a small cylindrical box, which, when made of good material and ornamented, will have an elegant and unobtrusive appearance.

All this will be more fully understood from the following detailed description with reference to the accompanying drawings, which form a part thereof, and in which I have shown, in—

Figure 1, a vertical sectional view of my improved microphone, constituting a part of my station apparatus; in Fig. 2, a plan view of the rear plate of my microphone; in Fig. 3, a vertical section of the whole station apparatus, with conventional diagrams of the call-bell and circuit connections; and in Fig. 4, a bottom plan view of the apparatus.

In the construction of my microphone I was guided by the requirements of the case. Since the induction-coil was to be omitted, it followed that the microphone must be so constructed as to produce the greatest possible variation of the strongest possible current. Consequently the contact between the electrodes must be at the same time intimate, the contact-points numerous, and the intimacy of contact must be greatly disturbed by the variations of the diaphragm. Since the whole apparatus was intended to be small, all these results must be obtained in a microphone of small dimensions, and in order to avoid the necessity of adjustment from time to time I was naturally led to the adoption of a gravity contact which would always automatically adjust itself with the original force as soon as the disturbing cause—viz., the vibration of the diaphragm—ceased. These requirements are fulfilled in the microphone, which is shown detached from the apparatus as a whole in Figs. 1 and 2.

A is a vibratory diaphragm of some poor conducting material, preferably carbon. B is a plate of similar poor conducting material, having a number of cylindrical cavities, *t*, upon one side, but the other side of which may be flat, as shown. In each of the cavities *t* is placed a spherical ball, *s*, of carbon or other poor conductor, which loosely fits the cavity; but each cavity is only deep enough to admit one-half of its corresponding ball, or a little less. It will therefore be understood that if there were no means of preventing it the balls would drop out of the cavities if the plate B were fixed in a vertical position. This, however, is just the position in which plate B is held, and the dropping out of the balls is

only prevented by diaphragm A, which is arranged parallel with plate B, and so close to the same that the balls, following their tendency to fall, will rest with a part of their weight against the inner face of the diaphragm, and with another part of their weight upon the edges of the cavities. The center of gravity of each ball, which corresponds to its geometrical center, will therefore be between the inner faces of plate B and diaphragm A, but much nearer to the former.

If the diaphragm vibrates under the influence of sound-waves, the contacts between each ball and the diaphragm on one side and the edge of the cavity on the other side will be varied, and the resistance of an electric circuit, of which the microphone forms a part, will also be correspondingly varied. By reason of the great number of contacts which my arrangement permits to be used a strong battery may be employed, and the current from the same will be very greatly varied at each vibrationof the diaphragm. It will also be seen that a break of circuit cannot occur in the operation of my instrument, even under the influence of very loud sounds, owing to the comparatively great number of contacts, all of which are independent of each other, and all of which have a decided tendency to maintain the circuit intact. The balls *s s* are very light, and each of them touches the diaphragm at one point only, so that the diaphragm has to overcome only a very small mechanical resistance, and the faintest sounds will greatly vary the contact-pressure. The microphone is therefore very sensitive; but however greatly the initial contact-pressure is varied by the variations of the diaphragm, it will always return to its original force as soon as the vibrations cease. Thus no adjustment of contact is required.

I am aware of the numerous arrangements of microphonic contacts of Bonta, Clay, Berliner, Drawbaugh, and others, wherein a ball or balls or rolling or sliding cylinders upon inclined planes are employed. In all these arrangements, however, the initial contact must be adjusted more or less. The distinguishing characteristic of my microphone over all these is that it has a great number of spherical contacts grouped together in a small space, each operating independently of the others, each pressing upon the diaphragm with the same constant initial force, and each located in a separate socket, while none of them require any adjustment whatever. In my station apparatus this microphone occupies the position shown in Fig. 3. There is a tube, E, of metal or other suitable material, open at both ends, and a disk partition, D, of hard rubber or wood or other insulating material divides the interior of the tube into two parts, as shown. In front this partition is recessed, as shown, to receive the back plate, B, of the microphone, in the recesses of which the balls *s* are located, and upon a ledge, *d*, of the partition the diaphragm is supported, and is held in place by a suitable annular washer, *r*, of soft rubber, paper, or other non-resonant material. An additional washer of metal may be placed over washer *r*, as shown. If the tube E is of metal, care must be taken to have the diaphragm insulated from the same.

The receiver T is shown in the drawings to occupy the space in the tube E in front of the microphone. This part of the tube constitutes the mouth-piece of the transmitter if the receiver is removed. The latter is of ordinary construction, consisting, in the main, of a metal cup, F, supporting a diaphragm, G, of soft iron and provided with a suitable ear-piece, G′. The permanent magnet *a q a* is made angular and is polarized to have a consequent pole in the middle at *q*. The ends *a a* of the magnet have therefore the same polarity, and the diaphragm being with its edges in contact with these poles thus becomes one of the poles of the magnetic system, the other pole of which is extended within inductive proximity to the same by means of the adjustable soft-iron core *q*, upon which the coil *q′* is placed. An annular block, K, preferably of insulating material, is placed over the coil, and, being screwed to the bottom of cup F, as shown, clamps the magnet and coil in position. The cup F is of such size and shape as to enter the front part of tube E, which constitutes the mouth-piece of the transmitter, with moderate friction. If placed in this position, the receiver appears like an ornamental cover to a box, and is safely held in this position. The two wires from the receiver-coil are embedded in a silk cord, *c*, which is received in a slot, *c′*, in the tube E when the receiver is in place.

The switch of the apparatus is mounted upon the rear face of partition D. There is a block, O, of insulating material projecting from the partition, and two leaf-springs, P and N are secured to the same by a strap, N′, or otherwise, parallel to each other. The spring P extends down through a slot, P′, in the casing or tube E, and at its free end it carries a push-button, P^2. Spring N is shorter than spring P. It overhangs the latter and terminates in front of and near a contact-plate, M, secured to the partition. Spring P passes in front of and near another contact-plate, H, also secured to the partition, and platinum points *x x* on the two springs are arranged for contact of these plates with each other and with the contact-plates.

A bell-crank lever, L, pivoted to a bracket, R, secured to the partition, is arranged with one end, L′, behind spring N, and with the other cam-shaped end, L^2, just in relation to a slot, E′, in the front part of tube E. The lever is pivoted at its vertical leg, which passes through a slot, E^2, in the tube E, and the horizontal leg of the lever which extends along the outer wall of the tube being thus overbalanced, the cam-shaped end of the same will drop into and through slot E′ if the receiver is not in place, as indicated in dotted lines in Fig. 3.

If the receiver is inserted into the mouth-

piece of the microphone, it will raise the horizontal arm of the lever, as shown in solid lines, the vertical arm of which will then press upon spring N, breaking the normal contact of the same with plate M and establishing contact between springs N and P.

When not acted upon by lever L, spring N makes contact with plate M, but is out of contact with spring P, while the latter is also out of contact with plate H.

The circuit connections are very simple, and are clearly illustrated in Fig. 3. One terminal of the receiver-coil is connected by wires *f f* with the diaphragm of the microphone, the back plate, B, of which is connected by a wire, *g*, with contact-plate M. The other terminal of the receiver-coil is connected by a wire, *h*, with the outgoing line, and the incoming line is connected with spring N, as shown. From spring P there is a connection, *y*, to the call-bell, the return-wire *z* from which is joined to the outgoing line, at a point, *z'*, from whence a connection, z^2, is carried to contact-plate H. A battery, Q, is placed at any desired point in the line.

The operation of the whole station apparatus will now be easily understood. In the condition of the apparatus shown in Fig. 3 the microphone and receiver-circuit is open at M *x*, and the incoming currents reaching spring N pass from there to spring P, then by wire *y* to the call bell, and by wire *z* to point *z'* of the outgoing line. The apparatus is therefore in condition to receive a call. It is also in condition to call the distant station, which is supposed to be similarly equipped, for if button P^2 is pressed so as to establish contact between spring P and plate H the current from one pole of the battery after traversing the line and the call-bell at the distant station will return by the incoming line to spring N, and then to spring P, contact-plate H, and wire z^2 to the outgoing line, back to the other pole of the battery, thus short-circuiting the bell, the microphone, and the receiver at the home station.

If the receiver is withdrawn from the mouth-piece of the microphone, the pressure of lever end L' upon spring N is removed, and the springs assume their normal positions, as above described. The apparatus is then in condition for oral intercommunication. The circuit through the apparatus is then from the incoming line to spring N, contact-plate M, wire *g*, to the back plate, B, of the microphone, then passing through the microphone and issuing from the same by wire *f* the current proceeds by said wire to the receiver-coil, and by wire *h* to the outgoing line, short-circuiting the bell.

This apparatus is fixed to a wall by means of screws or bolts passing through lugs Y Y on the tube E, or in any other convenient manner, and conversation is carried on and signals exchanged with the same ease and comfort and as effectively as by means of the voluminous apparatus now commonly in use.

In the drawings I have shown the line as a round metallic circuit; but it will be understood that a grounded circuit may be used in its place. It will also be understood that I do not confine myself to the exact details of construction herein shown and described, since the same may be variously modified without departing from the fundamental idea which underlies my invention.

Having fully described my invention, I claim and desire to secure by Letters Patent—

1. In a microtelephonic-station apparatus, a microphone consisting of a vertical diaphragm of semi-conducting material, a back plate of like material provided with a number of circular recesses facing the diaphragm, and a spherical ball of poor conducting material in each recess bridging the space between the diaphragm and back plate, substantially as described.

2. In a microtelephonic station apparatus, a microphone consisting of a vertical diaphragm of carbon, a carbon back plate provided with a number of cylindrical recesses facing the diaphragm, and a carbon ball for each recess bridging the space between the diaphragm and back plate, substantially as described.

3. In a microtelephonic-station apparatus, a microphone consisting of a vertical diaphragm of carbon, a carbon back plate parallel to the diaphragm and provided with a number of cylindrical recesses, and a carbon ball for each recess loosely resting upon the edge of the same and in gravity contact with the diaphragm, substantially as described.

4. In a microtelephonic-station apparatus, a microphone consisting of the combination of a vertical carbon diaphragm and a carbon back plate parallel to the diaphragm and provided with a number of shallow cylindrical recesses, with a carbon ball for each recess, projecting with its center of gravity beyond the edge of the recess and resting by gravity upon said edge and against the diaphragm, substantially as described.

5. In a microtelephonic-station apparatus, the combination of a disk of insulating material supporting a microphone upon one face and a switch upon the other face thereof, and a tube open at both ends inclosing the microphone and switch and constituting the mouth-piece of the former, with a switch-lever extending into the mouth-piece, a receiver fitting into the latter, and a push-button connected with a movable part of the switch, substantially as described.

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

CHARLES CLAMOND.

Witnesses:
ROBT. M. HOOPER,
O. KERN.