No. 607,994. Patented July 26, 1898.

T. J. HOWELL.

MICROPHONE.

(Application filed Jan. 3, 1898.)

(No Model.)

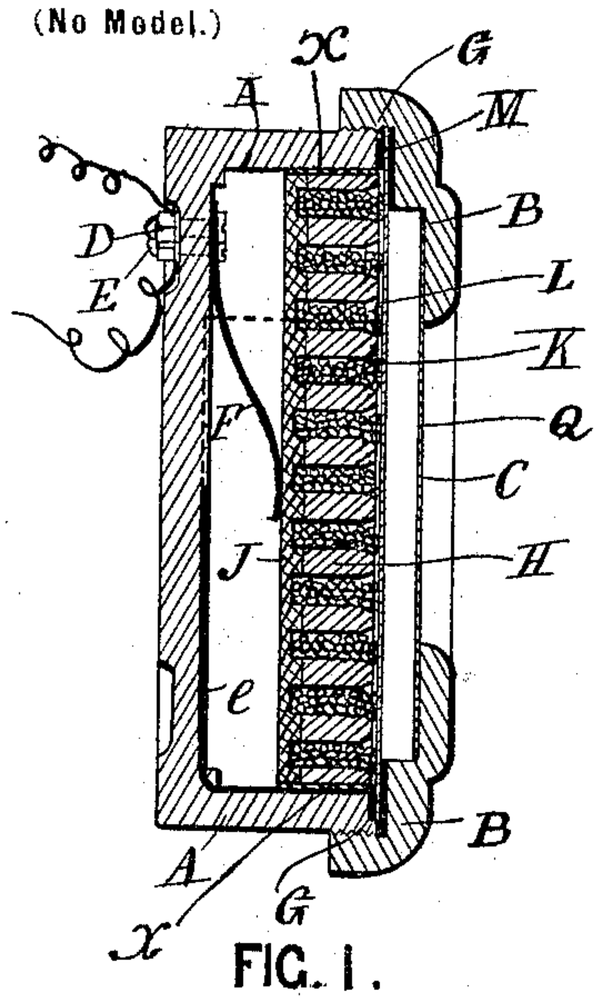

FIG. 1.

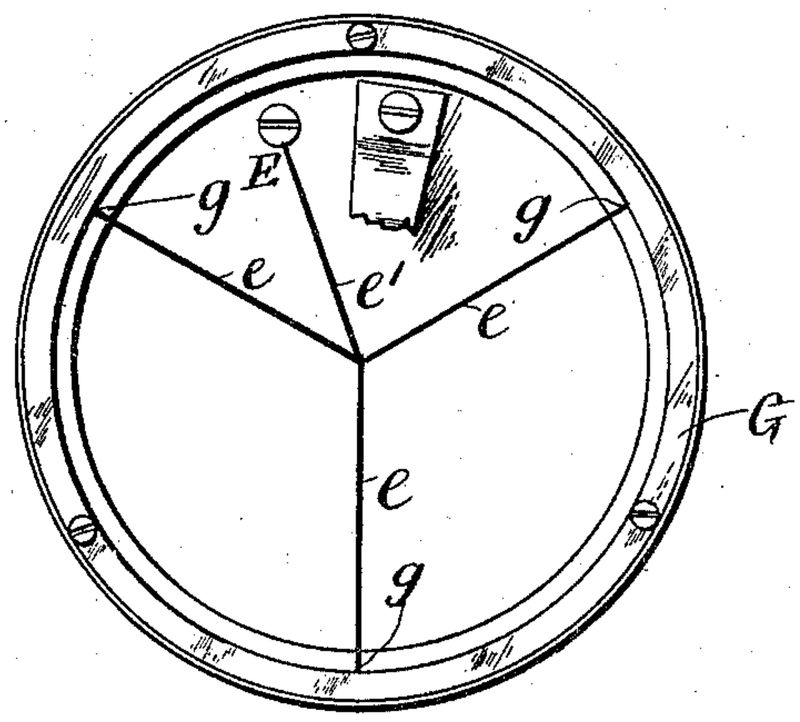

FIG. 2.

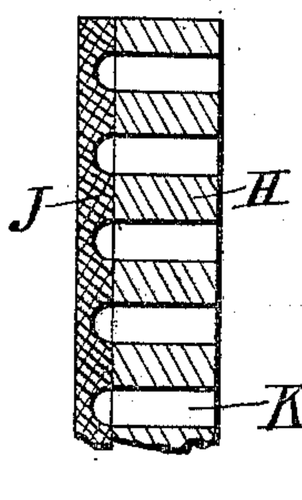

FIG. 3.

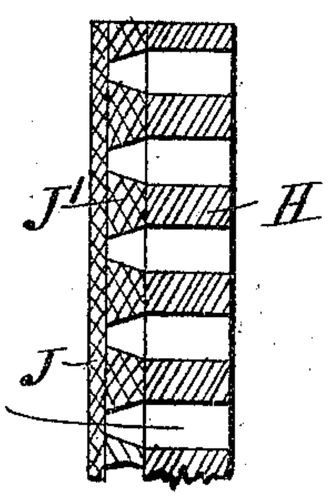

FIG. 4.

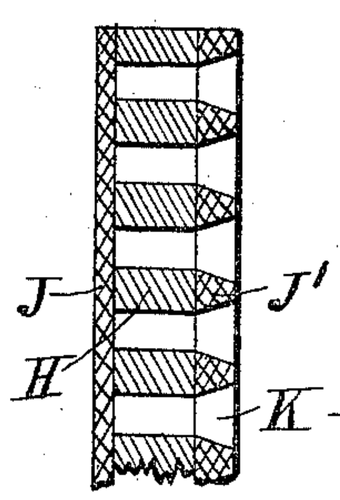

FIG. 5.

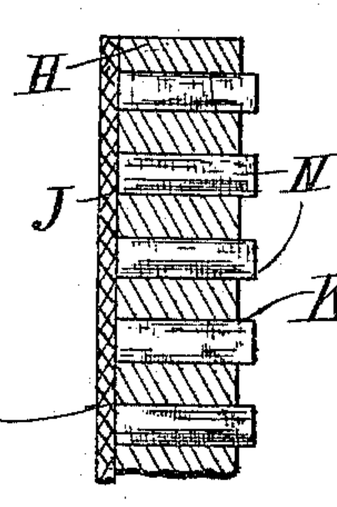

FIG. 6.

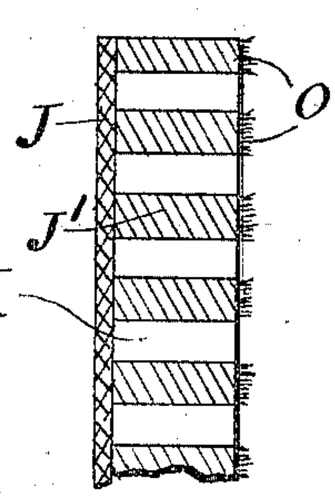

FIG. 7.

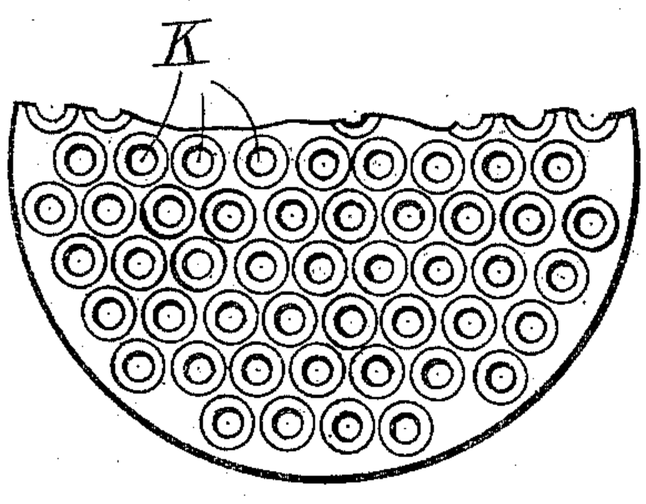

FIG. 8.

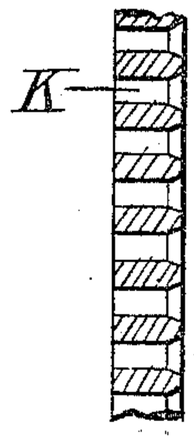

FIG. 9.

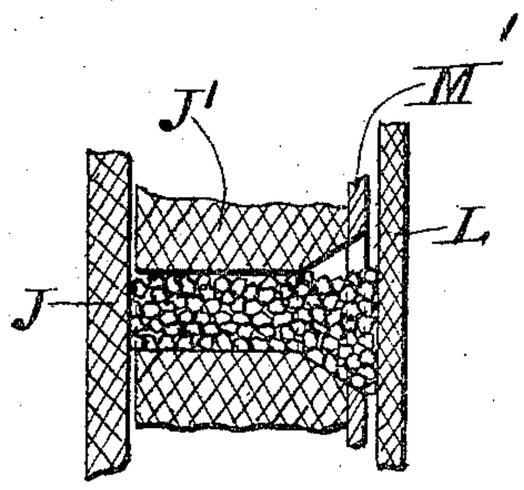

FIG. 10.

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UNITED STATES PATENT OFFICE.

THOMAS JAMES HOWELL, OF LONDON, ENGLAND.

MICROPHONE.

SPECIFICATION forming part of Letters Patent No. 607,994, dated July 26, 1898.

Application filed January 3, 1898. Serial No. 665,480. (No model.)

To all whom it may concern:

Be it known that I, THOMAS JAMES HOWELL, a subject of the Queen of Great Britain and Ireland, and a resident of 70 Farringdon road, London, England, have invented certain new and useful Improvements in Microphones, (for which I have made application for a patent in Great Britain, No. 24,574, bearing date November 3, 1896,) of which the following is a specification.

This invention relates to microphones; and my present improvements, such as hereinafter described, enable me to produce an instrument of increased sensitiveness and capable of being used with a current of either high or low power, as may be desired, without damage to the microphone or any part thereof; and, further, by the use of my invention the microphone remains equally sensitive at all times and does not require shaking or readjusting at intervals, as is so common with many such instruments now in use.

I therefore construct my improved microphone or transmitter in the following manner and as shown by the accompanying drawings, to which I will hereinafter refer.

In said drawings, Figure 1 shows a section taken through the thickness of my transmitter, and Fig. 2 shows a plan of the interior of the box portion thereof. Figs. 3 to 9 are intended to show, by way of suggestion, some modified forms in which the honeycombed or cellular disk may be made or built up; and Fig. 10 illustrates the position of the carbon granules in a single cell, (enlarged,) the mouth of which is countersunk or coned.

In carrying out my invention I make a box A of hard wood or any other suitable insulating or properly-insulated material, having a removable lid B, with central hole C, forming the mouthpiece of the microphone or transmitter.

I fix two terminals D and E (or more, if desired) preferably at the rear of the box, one, D, (or more,) being connected with a metal spring F, projecting inwardly toward the center of said box A, and the other, E, (or others,) being connected to a brass or other conducting metal ring G, secured upon the rabbet or edge of the box A, over which is to be passed the lid B. By preference I make the connection to the said ring G at more than one point—say, for instance, three points *g g g* equally distant apart—by means of three wires *e e e* of equal resistance, connected to a common wire *e'*, leading to the terminal E, my object being to centralize the speech or to balance the current and fluctuations equally around the center of the instrument. Similarly I may find it advantageous to employ more than the one central spring F aforesaid within the box at its rear.

The function effected by wires *e e* is as follows: If there were only one point of connection, the current would have a tendency to flow only through that portion of the instrument which is nearest to the point of connection of the conducting-wires, due to the natural tendency of an electric current to take the path of least resistance. It is not improbable that an instrument with only one connecting-wire would not have any current passing through the granules, which lie some distance away from the single point of connection.

The honeycombed or cellular disk aforesaid may be cut or stamped from a sheet of ebonite or other material of suitable thickness, whether cut or molded, or the disk may be built up of two or more layers of various materials. I find in practice that an efficient form of disk may be constructed as shown in Fig. 1, the ebonite or non-conducting portion of which, H, lies against the inner carbon or equivalent plate J (comprising the inner electrode) and may be held thereto by any suitable means, such as a strip of paper *x*, secured around the edge of the two disks. The disk H may be either punched, drilled, or molded over the whole of its surface completely through its thickness and also partly into the thickness of plate J, so as to form a number of cells K K K K K of convenient diameter and shape, each intended to contain a number of specially-prepared carbon granules screened to the minimum size which will prevent their falling down behind the carbon vibrating plate or tympan L. The mouths of the cells K are by preference cone-shaped or countersunk, as more fully explained in connection with Fig. 10.

My improved microphone is built up as follows: Within the box A and upon the projecting spring or springs F, I lay the honeycombed disk, with the electrode J inward. I

now fill the holes or cells K K with granulated carbon, carbon balls, or any equivalent thereof. The front face of the honeycombed or cellular disk H will now lie on a level with or come slightly in front of the metal ring G or rabbet of the box, and upon said ring G, I lay the final plate L of thin carbon or equivalent, which is to form the vibrating diaphragm or tympan, (comprising the outer electrode;) but sufficient space must be provided between the openings of the cells K K and the plate L to allow of this vibration. It is important, however, that this space be not so large as to allow the grains of carbon or the like to fall down between the honeycombed or cellular disk H and the said carbon plate L. Finally the lid or mouthpiece B is screwed or wedged on the box A over the thin carbon plate L, a ring M of felt, rubber, or the like being provided, so as to prevent said plate from accidentally breaking under the pressure.

I will now proceed to describe shortly a few of the modified forms which the honeycombed or cellular disk may take.

In Fig. 3 is shown a disk H made, preferably, of ebonite, hard wood, or non-conducting or only feebly-conducting material, having cells K K, the mouths not being countersunk, as in Fig. 1, for containing loose carbon or equivalent, the latter forming the electrical connection between the vibrating plate and the back or inner plate of carbon J, which may either be separate from or cemented or otherwise attached to said honeycombed disk H, said plate J being sufficiently thick—say one-quarter of an inch or more—for the holes K K to be continued into the same without extending right through, a larger contact area being thus provided for the innermost carbon granules of each cell. The cells are shown rounded at the ends in Fig. 3 and square in Fig. 1. The said carbon or equivalent plate J may, however, if preferred, be in two thicknesses or layers, as shown by Fig. 4, the outside layer J being a plain disk and the inner layer J′ adjacent to the non-conducting honeycombed disk H being perforated, so as to register therewith. The inner of the cells which are contained within the layer J′ may be cone-shaped or tapered, as shown.

In Fig. 5 is shown an arrangement in which the relative positions of the carbon disk J′ and ebonite or equivalent disk H are reversed. It is possible, I find, to have many variations in the arrangement of the carbon and ebonite disks, and I do not wish to limit my present application for a patent to any arbitrary form such as shown by the accompanying drawings. In every case, however, the rear or inner disk J must be of carbon or other conducting material, either a plain disk or partially perforated; but the remaining perforated disk or layers of disks may be of any suitable material, whether insulating or conducting or of both kinds in combination. Thus, referring to Figs. 4 and 5, the disks J′ and H may both be made of carbon or the like or both of ebonite or the like or either one of them may be of either material. It is obvious that the disk H in Fig. 5 may have cone-shaped cells, if desired, or the cells throughout may, if desired, be tapered.

I may find it advisable for some purposes to provide each cell K K, Fig. 6, with a small accurately-fitting open tube N, of silk, rubber, or other equivalent material, projecting forwardly, so as to touch or nearly touch the vibrating plate or tympan, the outermost carbon or equivalent granules being supported upon the projecting ends of said tubes N N, and thus being held sufficiently against the diaphragm without impairing the latter's vibratory powers. I may employ an equivalent manner of treating the honeycombed disk—namely, by coating its face with some sticky substance and covering it with cotton-wool chippings or other fluffy material O or otherwise covering it, excepting at the opening of each cell, as indicated by Fig. 7.

Figs. 8 and 9 show a broken plan and section, respectively, of the simplest form of my honeycombed disk, perforated through from back to front, with passages or cells K K countersunk or widened out into cone-shaped mouths, as shown more clearly in Fig. 10, which is an enlarged section of one of these cells. If the perforated disk be of carbon, it may be painted or coated over its outer surface with shellac, or a thin layer of ebonite M′ or other insulating substance in sheet form may be superposed over the face of the disk, though this may not always be necessary. The object of the conical formation of the mouths is to cause the granules to slide or fall of their own weight until they bear lightly against the carbon diaphragm L. When the microphone is being used, the granules will receive the impulses and be constantly agitated in proportion to the amplitude of vibration of said diaphragm or tympan L. The rear electrode vibrates with the front diaphragm, but with a diminished amplitude. Were it to vibrate exactly in the same degree as the diaphragm there would hardly be any variation of resistance among the carbon granules. The rear electrode does not vibrate independently of the perforated disk or disks, to which it is attached at the edges, excepting possibly in a very small degree at the center. The whole mass or system of perforated disks will, by bearing freely against a spring F, as described, instead of against an unyielding connection, be capable of a certain amount of vibration with the front disk or diaphragm L, and said spring may be of spiral or any other form most suitable.

The mouthpiece or opening of the lid B may contain a piece of gauze Q, serving as a screen to prevent the breath from settling or condensing upon the tympan L.

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

1. In combination in a microphone, a honeycomb disk having a series of cells, the front diaphragm, a screw-down cover to hold the diaphragm in place in front of the honeycomb disk, a rear plate extending across the series of cells in the disk and a conducting-spring for forcing the rear plate with the honeycomb disk forward as a whole, the said cells being filled with carbon granules, substantially as described.

2. In combination in a microphone with the case, the disk therein having the series of cells with carbon granules therein, the metallic ring G on the case and about the edge of the disk, the diaphragm L extending over the front face of the disk with its cells and resting upon the ring G, the electric terminal E and a plurality of wires leading from the terminal E to different points on the ring G, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

THOMAS JAMES HOWELL.

Witnesses:

HARRY GEE,

JAMES LEWIS.