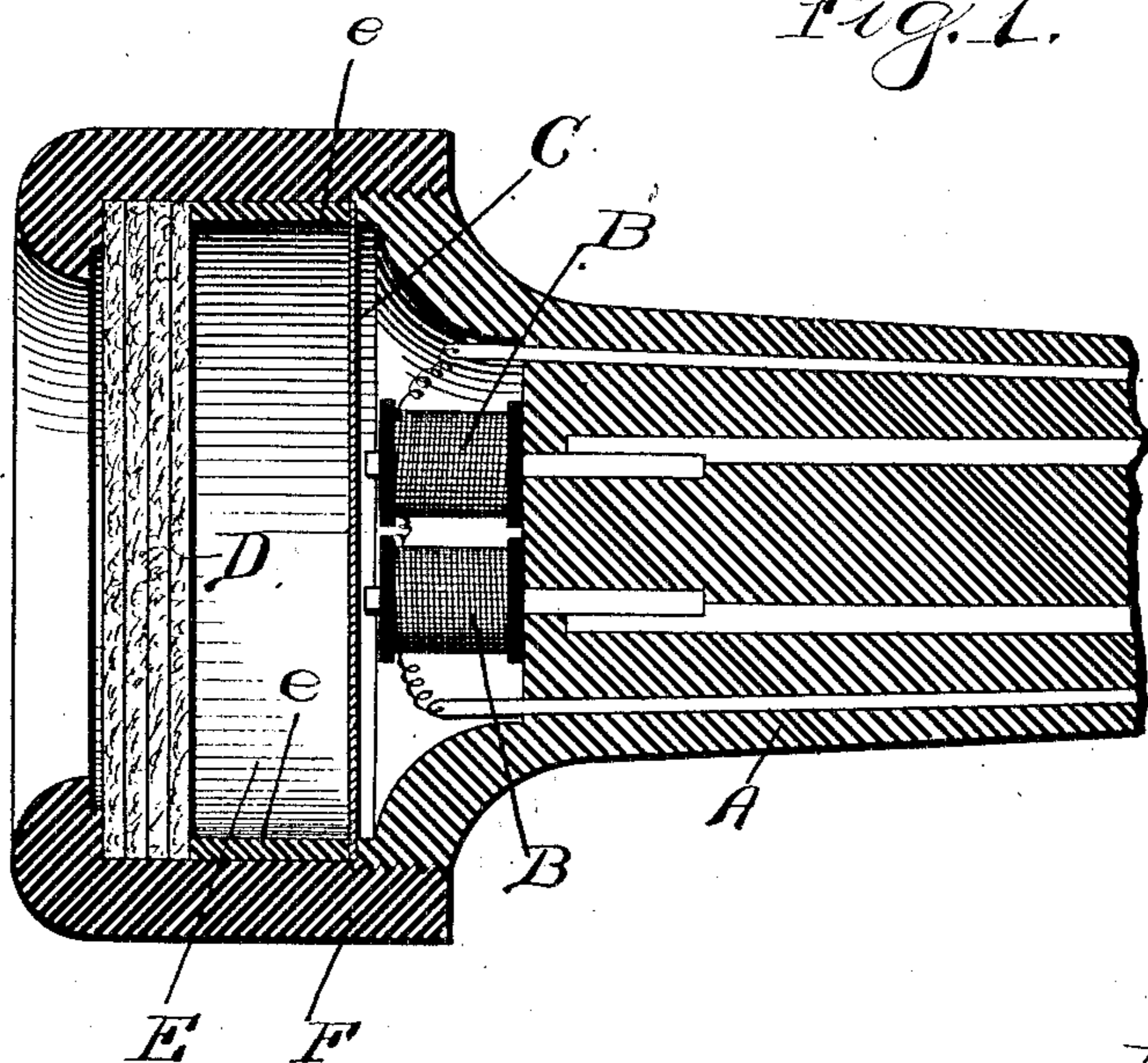


No. 871,470.

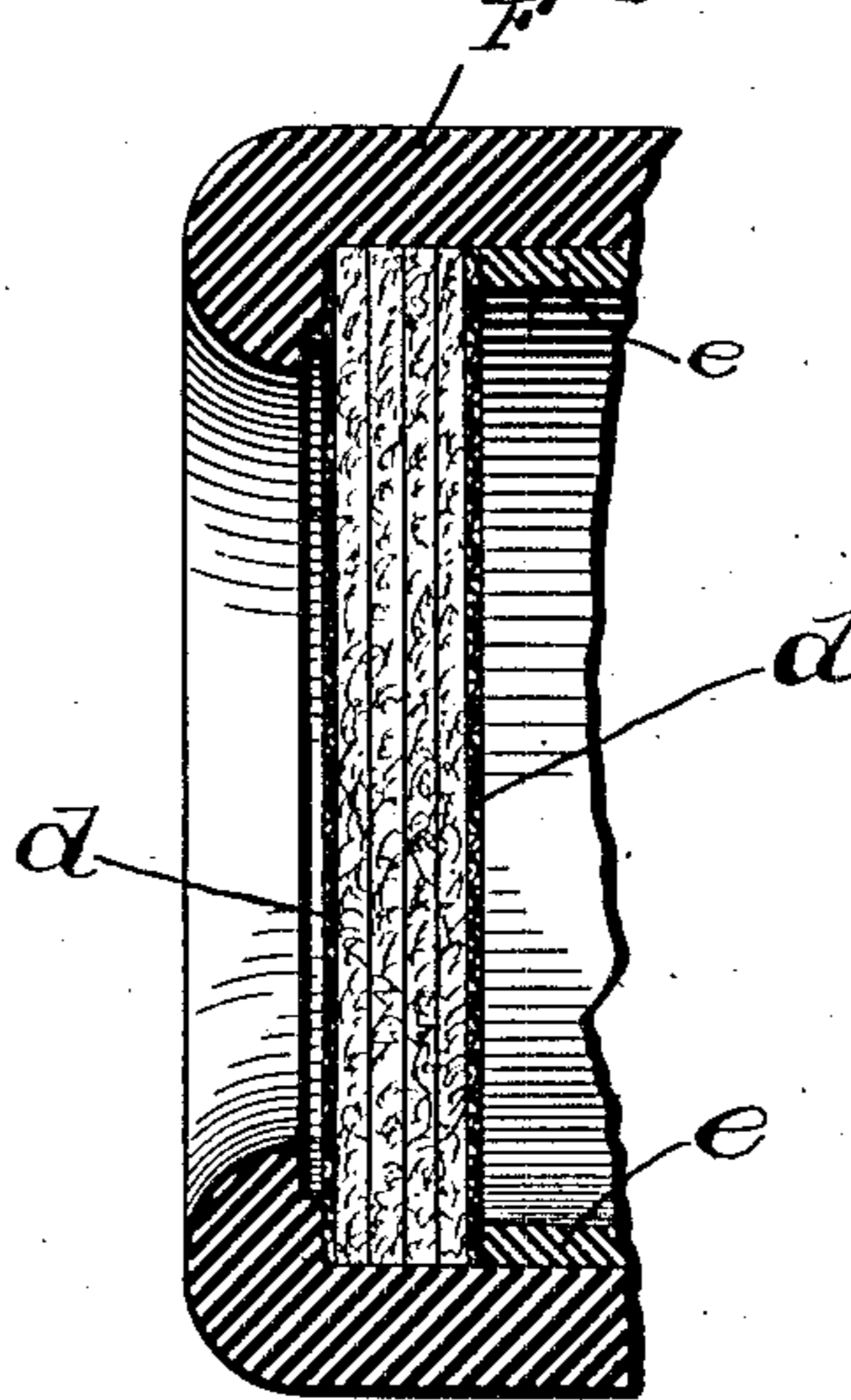
PATENTED NOV. 19, 1907.

H. E. BOOTH.  
TELEPHONE RECEIVER.  
APPLICATION FILED SEPT. 8, 1902.

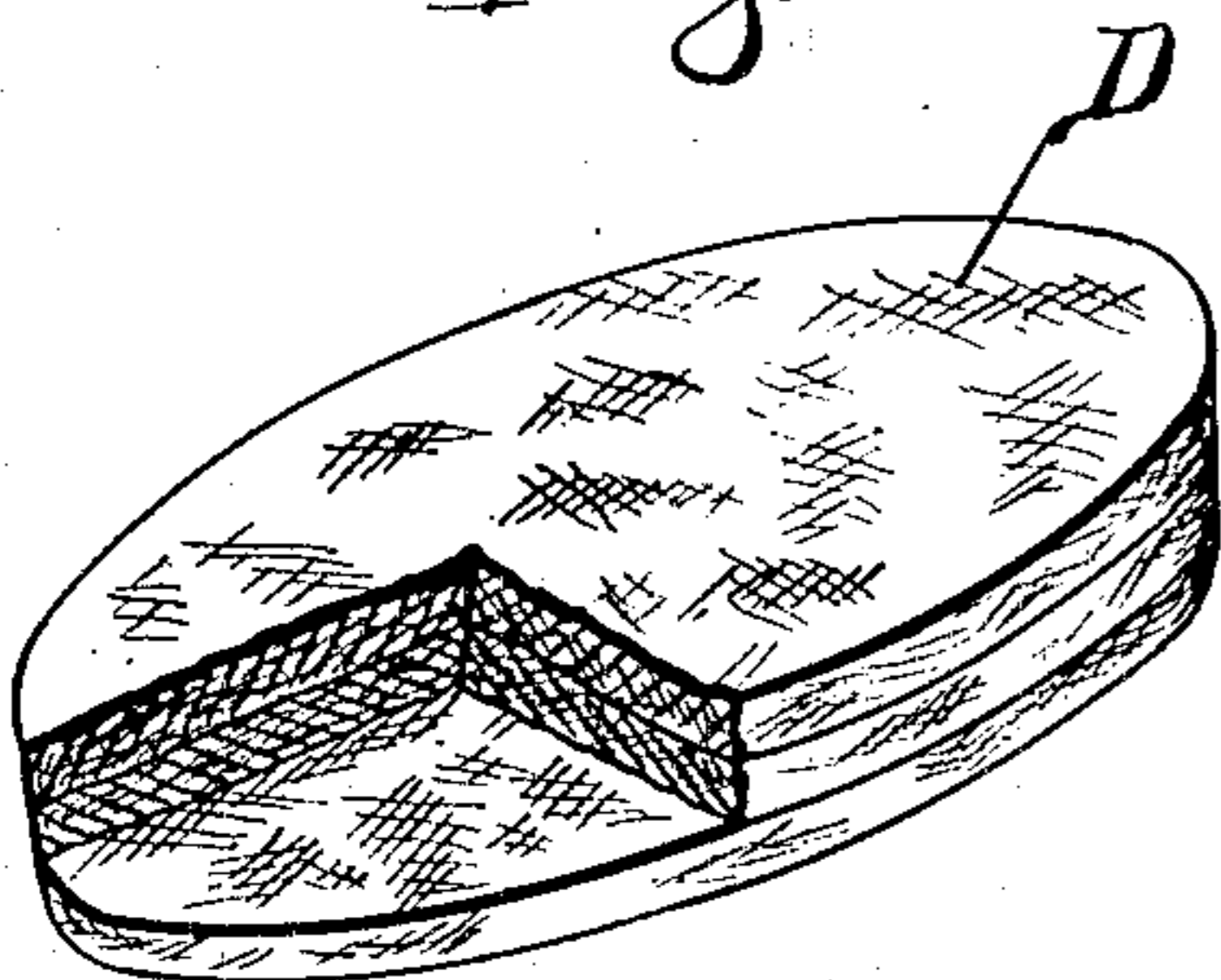
*Fig. 1.*



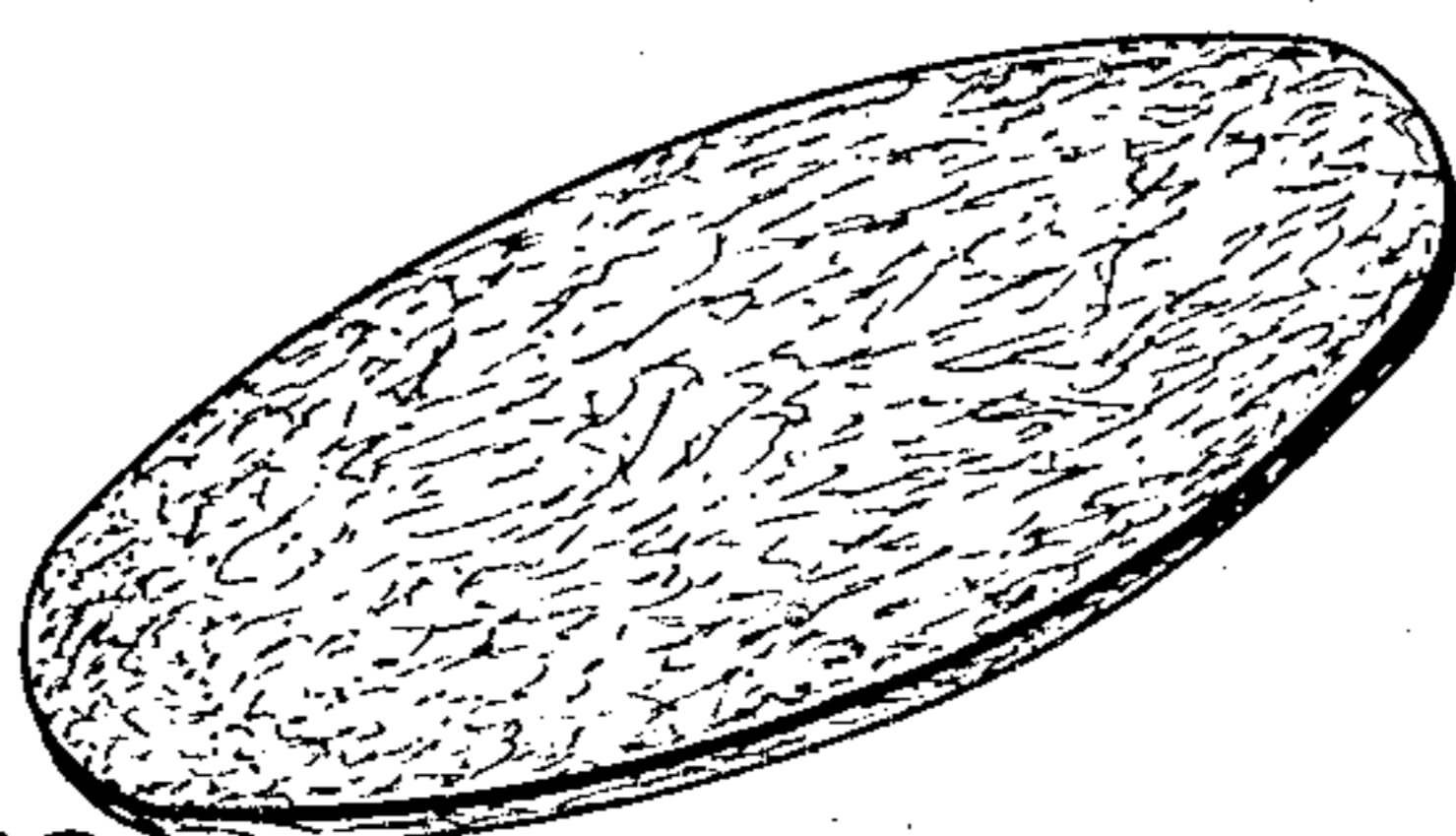
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



Witnesses:  
J. B. Weir  
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Inventor:  
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By Arthur F. Leland  
Att'y.

# UNITED STATES PATENT OFFICE.

HIRAM E. BOOTH, OF SALT LAKE CITY, UTAH.

## TELEPHONE-RECEIVER.

No. 871,470.

Specification of Letters Patent.

Patented Nov. 19, 1907.

Application filed September 8, 1902. Serial No. 122,517.

*To all whom it may concern:*

Be it known that I, HIRAM E. BOOTH, a citizen of the United States of America, and resident of Salt Lake City, Salt Lake county, Utah, have invented a certain new and useful Improvement in Telephone-Receivers, of which the following is a specification.

My invention contemplates a telephone receiver having an auxiliary diaphragm adapted to modify and clarify the tones in such manner as to relieve them of all harshness and render them very clear and distinct.

Furthermore, my invention contemplates a telephone receiver having a supplemental or auxiliary diaphragm of a more or less porous and non-vibratory character, and thus adapted to, not only, as stated, render the tones more distinct and agreeable to the ear, but, in addition, to preclude all possibility of shock or injury to the ear or eardrum, such as might result from the sudden changes of potential on the telephone line, as in making and breaking connections, and particularly as is the case in some telephone systems when batteries are cut out of circuit.

More specifically, my invention contemplates an auxiliary diaphragm having a multitude of very fine openings.

In the accompanying drawings, Figure 1 is a longitudinal section of a telephone receiver embodying the principles of my invention. Fig. 2 is a sectional view of another form of porous and non-vibratory diaphragm. Fig. 3 is a perspective of my improved diaphragm, showing the same composed of three layers. Fig. 4 shows a diaphragm composed of but one layer.

As thus illustrated, my improved telephone receiver may comprise a casing A of any suitable known or approved form. The electro-magnets B may also be of any suitable form or character. The usual metallic and vibratory diaphragm C can be arranged in front of the magnets in the usual manner. In accordance with my invention, however, a supplemental diaphragm D is preferably arranged directly in front of the vibratory diaphragm C, it being observed that the two diaphragms are preferably separated to an extent sufficient to provide a resonance chamber E. In other words, the two diaphragms are preferably separated by an intervening body or air. Both diaphragms can be held upon the end of the casing by the cap F, which can be screwed upon the casing A. A separating ring e can be employed for

maintaining the proper distance between the two diaphragms. In this way, the cap serves to clamp the two diaphragms, and also the ring, securely upon the end of the casing. The said supplemental or auxiliary diaphragm is preferably of sufficient thickness to be more or less non-vibratory in character, and is also preferably porous in character. For example, it may be composed of one or more layers of cloth, cotton wadding or some similar fibrous material arranged in sheets or layers. Again, it may be composed of front and back metal plates with intervening layers of cloth or fabric of any character, these two front and back plates or disks, being provided with a multitude of fine openings, such as might characterize a couple of disks of fine wire gauze or finely perforated disks of hard rubber, metal, wood, glass or the like. Thus it will be seen that this auxiliary diaphragm, which, as stated, is preferably of a non-vibratory and porous character, may be composed of various materials, such as metal, wood, cloth, glass or any similar material, it being preferable, however, that the materials employed are of a character to provide a diaphragm which, as stated, is more or less non-vibratory in character. At any rate, I find that very good, and perhaps the best, results are obtained by employing a diaphragm composed of one or more layers of cloth or cotton wadding, or by using, as stated, a couple of perforated disks of glass, wood, hard rubber, metal, isinglass or the like, with glazed cotton wadding, cloth or other fibrous material between them. It is obvious, however, that various materials may be employed for this purpose, and for this reason I do not limit myself to any particular material or materials for constructing the diaphragm. Now with a telephone receiver thus constructed with a vibratory or sound producing diaphragm, and also with a porous and non-vibratory diaphragm, I find that the sounds are relieved of all harshness and are also clarified and made very distinct and agreeable to the ear. This will be of particular value in long distance telephone systems, as I find that by employing a receiver of this character on a long distance line, I experience no difficulty whatever in receiving and understanding conversation transmitted from the other end of the line. I also find that with a receiver of this character the operator may make and break connections, and may also produce sudden changes of poten-

tial on the line, such as might result from cutting out batteries and testing the line, or ringing the bell while the receiver is held to the ear, without causing shock or injury to the ear-drum, and practically without producing any irritation whatever to the ear. But one of the prominent characteristics of my invention is, that it involves a sound originating or producing vibratory diaphragm arranged in conjunction with an auxiliary or receiving diaphragm which, as explained, is preferably of a porous and non-vibratory character. In this way, the receiver, as explained, involves a vibratory and a non-vibratory diaphragm with an intervening air space. I would suggest that in order to secure the best results that minerals or metals, woods or hard rubber or other materials that are non-magnetic be employed for the auxiliary diaphragm. It is possible that any and all metals and materials may be employed with more or less satisfactory results, but it is obvious that better results will be insured if the auxiliary diaphragm be in no way subject to the magnetic influence of the electro-magnets. Thus it would appear much better to employ glass, wood, hard rubber, aluminium, or other like materials for the perforated disks or sheets involved in the construction of the diaphragm shown in Fig. 2. With materials of this character, the diaphragm will not be attracted when the electro-magnets are energized.

I find that very good results can be obtained in producing clearness of the sound or voice by using a vibratory diaphragm as the auxiliary diaphragm, but in such case I find that the auxiliary diaphragm is vibrated by the diaphragm immediately in front of the electro-magnet, and consequently disagreeable, and shocks and vibrations are apt to be conveyed to the ear of the person using the receiver. But when an air space is left between the two diaphragms, and when the auxiliary diaphragm is non-vibratory and characterized by a multitude of fine openings, the receiver is rendered far superior to those having but a single diaphragm. This is so when the auxiliary diaphragm is made of a thin sheet or sheets of isinglass or glass or other like materials. But where a vibratory auxiliary diaphragm is used the injury to the ear or ear-drum is apt to be the same as with the ordinary single diaphragm. By the term non-vibratory I do not necessarily mean an absolutely rigid diaphragm, but merely a diaphragm less vibratory than the diaphragm vibrated by the electro-magnet, and immediately in front of the latter. The auxiliary

diaphragm is preferably constructed so that it will have but little, if any, vibration, but if porous as herein described, will permit the sound to reach the ear, after being softened and clarified and rendered extremely agreeable to the ear. And by porous diaphragm, I mean a diaphragm which is composed of material having minute pores as distinguished from a diaphragm which is merely perforated. And by a non-vibratory diaphragm, I mean a diaphragm which is practically non-vibratory, or which is non-resonant, so to speak.

I claim as my invention—

1. In a telephone receiver, the combination of a vibratory diaphragm, means for causing said diaphragm to vibrate for the purpose of producing sound waves, and a porous and non-vibratory diaphragm arranged to receive the sound waves propagated by the vibratory diaphragm, with an air space between, said last mentioned diaphragm consisting of front and back disks with interposed fibrous material.

2. A telephone receiver comprising a suitable casing, an electro-magnet, a vibratory diaphragm arranged in front of said magnet, and an auxiliary diaphragm arranged in front of said vibratory diaphragm, with an air space between, said auxiliary diaphragm consisting of front and back sheets of perforated material with interposed fibrous material.

3. A telephone receiver comprising a suitable casing, an electro-magnet, a vibratory diaphragm arranged in front of said magnet, and a porous and non-vibratory diaphragm arranged in front of said vibratory diaphragm, with an air space between, said last mentioned diaphragm being composed of non-magnetic material having a multitude of fine openings and with interposed fibrous and porous material.

4. A telephone receiver comprising a suitable casing, an electro-magnet, a vibratory diaphragm arranged in front of said magnet, and an auxiliary diaphragm arranged in front of said vibratory diaphragm, with an air space between, said auxiliary diaphragm being less vibratory than the said diaphragm in front of said magnet and consisting of a suitable number of perforated sheets of hard material with interposed fibrous material.

Signed by me at Salt Lake City, Salt Lake county, Utah, this 25 day of August, 1902.

HIRAM E. BOOTH.

Witnesses:

EDDY O. LEE,

MORRIS L. RITCHIE.