Dec. 10, 1929. A. H. INGLIS ET AL 1,738,653

TELEPHONE RECEIVER

Filed Nov. 24, 1925

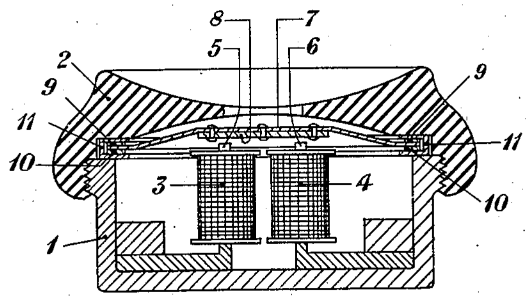

Fig. 1

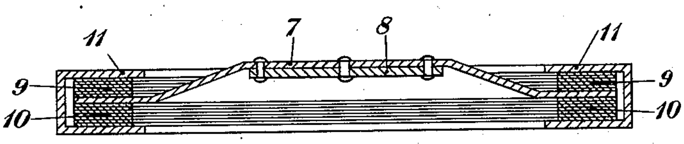

Fig. 2

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UNITED STATES PATENT OFFICE

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TELEPHONE RECEIVER

Application filed November 24, 1925. Serial No. 71,231.

This invention relates to telephone receivers and consists in a novel construction and mounting of the receiver diaphragm.

As is well known in the art, the diaphragm of the ordinary telephone receiver is a thin iron disc clamped tightly between the brass receiver case and the hard rubber cap and lying opposite the pole pieces of the magnetic unit. With this construction and arrangement of the diaphragm, there are certain undesirable effects of temperature changes and also the likelihood of acoustic shock. Furthermore, there are undesirable resonance effects, due to the sharply defined natural period of vibration of the diaphragm.

Applicants' invention has as its principal objects the elimination of the effects of temperature changes, the elimination, or at least the minimization, of the resonance effects, and the elimination of acoustic shock. In addition to the advantages found in the attainment of these objects, the improved receiver has other advantages which will be disclosed and discussed below.

In order to attain the objects named above, applicants provide a floating diaphragm of novel construction and design.

This diaphragm structure and the arrangement of its mounting will be more clearly understood when the following detailed description is read with reference to the accompanying drawing. Figure 1 of the drawing shows in cross-section the preferred form of applicants' receiver, and Fig. 2 is an enlarged cross-sectional view of the diaphragm and the mounting therefor. It is to be understood that the form and proportions of the diaphragm and the spacing are greatly exaggerated, for purpose of clear description. Like numerals of reference in the two figures of the drawing designate corresponding parts of the device.

With reference to the details of the drawing, the receiver case 1, the receiver cap 2, and the electromagnets 3 and 4, with their pole pieces 5 and 6, respectively, are parts found in the ordinary receiver.

The diaphragm structure comprises two members, the diaphragm proper 7 and the magnetic diaphragm or armature 8. The member 7 is constructed from a thin piece of suitable metal of very light weight, such as duralumin, non-magnetic and having a relatively low specific resistance. It is shown in the form of a shallow cone with a flat top, but any form giving rigidity is suitable. The member 8 is fixed to the under side of the flat portion of the diaphragm 7 and consists of a small, thin disc of magnetic material of high permeability, such as permalloy. This member 8 lies oposite and close to the pole pieces 5 and 6 and acts as an armature. The diaphragm 7, together with the magnetic diaphragm 8 attached thereto, instead of being tightly clamped between the receiver case and cap, is loosely supported between piles of thin washers 9 and 10. These washers should be of thin material such that the piles of washers will include sufficient air between layers to provide air damping of the moving system. Condenser paper is suitable, and aluminum foil is also found to be satisfactory. A spun metal ring 11, of brass or any other suitable material and of any suitable construction, may be used to hold this assembly in a single unit.

The member 8 must be constructed of a material which has the characteristics of higher initial permeability than iron and a lower value of magnetization at saturation. Permalloy is the most desirable material known to the applicants, and a suitable variety of permalloy is a composition of nickel and iron, in which the nickel component predominates. In certain cases it may be desirable, for reasons other than those relating directly to this invention, that ingredients other than nickel and iron be added to the composition. The permeability of permalloy at very low magnetizing forces is remarkably high, being of the order of 6,000 for zero magnetizing force, whereas the corresponding value for the best grades of iron is only about 300. For an amplified description and discussion of permalloy and its production, reference may be had to the disclosure found in the United States Patent to O. E. Buckley, No. 1,586,876, dated June 1, 1926.

Applicants' receiver has the following advantages:

1. The diaphragm structure, being of very light weight and being air-damped by virtue of the piles of washers between which it is mounted, will act, not as a vibrating diaphragm, but as a plunger, and will have a very slight or no natural period. The greatly reduced mass of moving parts produces an improved match of "acoustic impedance" between the diaphragm and the air load, resulting in an improved transfer of energy and greater efficiency.

2. Since the diaphragm structure is not clamped or otherwise rigidly connected to the case, changes of temperature do not distort the diaphragm and alter the separation between that structure and the pole pieces of the magnetic device, but, on the contrary, there is a practically constant separation over a wide range of temperature. Consequently a much smaller initial separation may be provided, with the result of greater efficiency.

3. The use of the small magnetic diaphragm with a sharp magnetic saturation point, combined with and fixed to a diaphragm of low specific resistance, as disclosed, will eliminate, or at least greatly reduce, acoustic shock. Given a proper design of the magnetic circuit, the armature or magnetic diaphragm will function under normal volume conditions below the saturation point. With such conditions the flux will be almost altogether confined to the armature, with only a negligible part of it cutting the main diaphragm. Any sudden increase in volume, however, will saturate the armature. In such a case the flux will cut the duralumin diaphragm, setting up eddy currents, which will heavily damp the moving system and thus reduce the resultant displacement to a point at which it will not be objectionable.

It is thus seen that applicants provide a receiver having a greater motor efficiency than is the case with the ordinary receiver, since a much smaller separation can be maintained between the pole pieces and the diaphragm structure without danger of freezing. Again, the improved receiver will be more pleasant to use than the ordinary receiver because of the reduction of the resonance effects and the elimination of acoustic shock. Furthermore, applicants' receiver can be advantageously used on a hand set, since the response is not so marked as it is in the ordinary receiver, and consequently the danger of howling is materially reduced.

While the invention has been disclosed in one specific embodiment which is deemed desirable, it is to be understood that it is capable of embodiment in many other and widely varied forms without a departure from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A telephone receiver including a magnetic device, a floating diaphragm, and a member fixedly mounted on said diaphragm in proximity to said magnetic device, said member having higher initial permeability than iron and lower value of magnetization at saturation.

2. A telephone receiver including a magnetic device, a floating diaphragm, and a member fixedly mounted on said diaphragm in proximity to said magnetic device, said member being of a magnetic alloy consisting chiefly of nickel and iron and having a higher initial permeability than iron and lower magnetization at saturation.

3. A telephone receiver including a magnetic device, a floating diaphragm, and a member fixedly mounted on said diaphragm in proximity to said magnet device and being of an alloy consisting chiefly of nickel and iron and in which the nickel componenet predominates, said member having higher initial permeability than iron and lower magnetization at saturation.

4. A telephone receiver including a magnetic device, a floating diaphragm, and a permalloy member fixedly mounted on said diaphragm in proximity to said magnetic device.

5. A telephone receiver including a magnetic device, a floating diaphragm of non-magnetic material having relatively low specific resistance, and a member fixedly mounted on said diaphragm in proximity to said magnetic device, said member having higher initial permeability than iron and lower value of magnetization at saturation.

6. A telephone receiver including a magnetic device, a floating diaphragm of non-magnetic material having relatively low specific resistance, and a member fixedly mounted on said diaphragm in proximity to said magnetic device, said member being of a magnetic alloy consisting chiefly of nickel and iron and having higher initial permeability than iron and lower magnetization at saturation.

7. A telephone receiver including a magnetic device, a floating diaphragm of non-magnetic material having relatively low specific resistance, and a member fixedly mounted on said diaphragm in proximity to said magnetic device and being of an alloy consisting chiefly of nickel and iron and in which the nickel component predominates, said member having higher initial permeability than iron and lower magnetization at saturation.

8. A telephone receiver including a magnetic device, a floating diaphragm of non-magnetic material having relatively low specific resistance, and a permalloy member fixedly mounted on said diaphragm in proximity to said magnetic device.

9. A telephone receiver including a magnetic device, a rigid floating diaphragm of non-magnetic material having relatively low

specific resistance, and a member fixedly mounted on said diaphragm in proximity to said magnetic device, said member having higher initial permeability than iron and lower value of magnetization at saturation.

In testimony whereof, we have signed our names to this specification this 23rd day of November 1925.

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