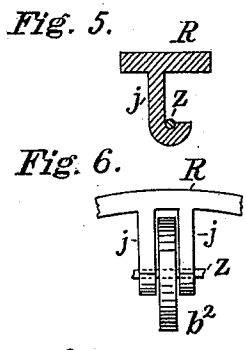
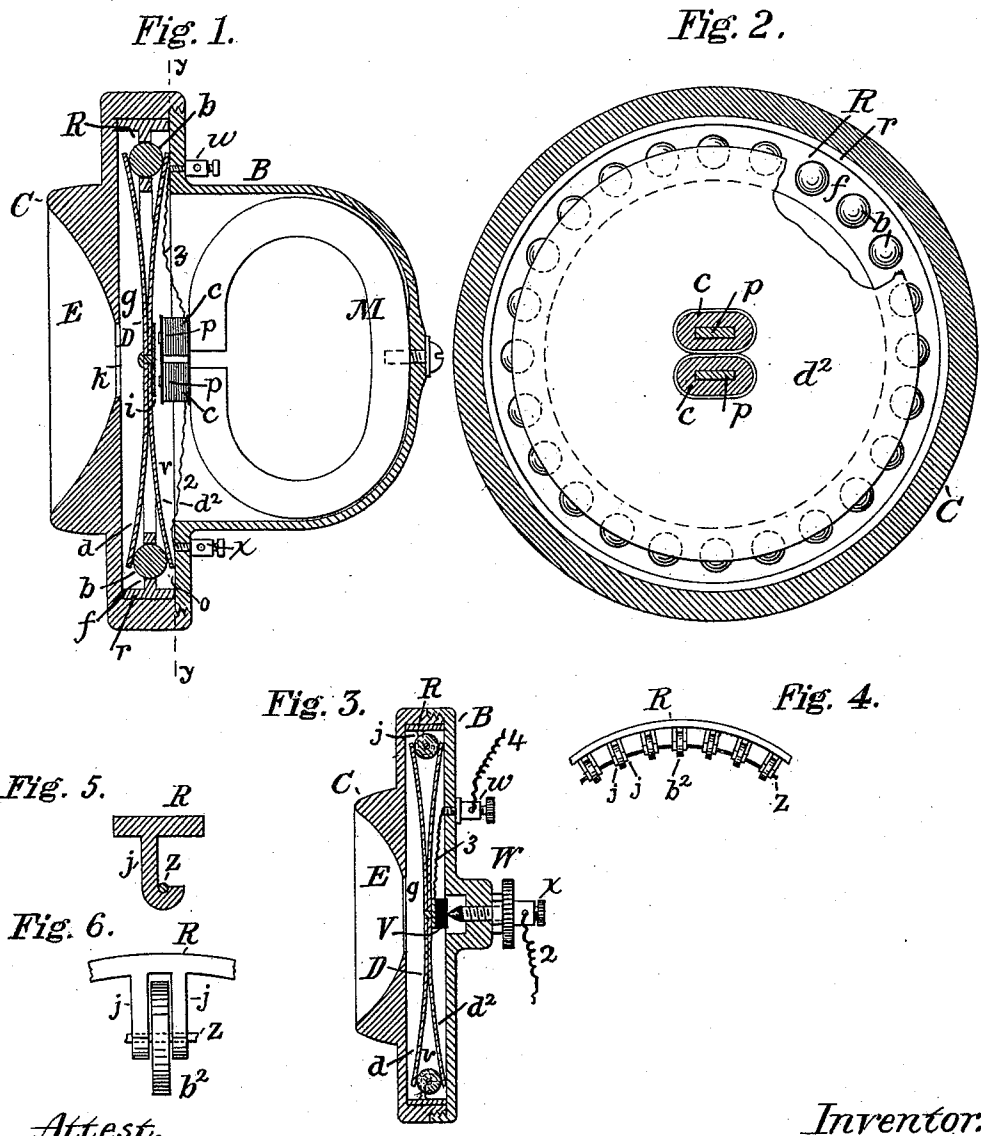


(No Model.)

S. D. FIELD.
TELEPHONE.

No. 523,630.

Patented July 24, 1894.



Attest.

Joseph A. Gately
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Inventor:

Stephen D. Field

UNITED STATES PATENT OFFICE.

STEPHEN D. FIELD, OF STOCKBRIDGE, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 523,630, dated July 24, 1894.

Application filed April 7, 1894. Serial No. 506,696. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN D. FIELD, residing at Stockbridge, in the county of Berkshire and State of Massachusetts, have invented certain Improvements in Telephones, of which the following is a specification.

This invention relates to speaking telephones, and its object is to secure in one instrument the uniform action, and sharpness of operation, dependent upon the employment of thick diaphragms, and the lightness and delicacy necessary for satisfactory operation, which has so far made requisite vibrating plates of diaphragms of extreme thinness.

My improvement is applicable to both transmitting and receiving telephones, and to those of the former class whether the diaphragm be employed to effectuate the required changes of current by varying the resistance of a circuit in which an electrical current from an independent source is already circulating, or by itself constituting or supporting the movable part of a generator, and thus when operated acting to set up a variable electromotive force, the resistance being constant.

As usually heretofore constructed, telephone diaphragms have consisted of a single, generally round, plate of metal or other suitable material clamped at the edges, or supported by spring pressure, and have been subjected to more or less stress by reason either of the attracting power of a magnet or of some mechanical device centrally applied.

I have ascertained that a combination of thin diaphragms may be made and so arranged as to give all the magnetic conductivity, rapidity of motion, and accuracy of vibration incident to a thick vibrating plate, preserving at the same time the lightness and delicacy of action which are characteristic of thin plates.

My invention comprises a compound telephone diaphragm mounted on supports which permit free radial movement thereof, and which may for example be ball bearings; a diaphragm so constructed and mounted being applicable as an armature not to telephones only, but to electro magnets of any class; and comprises also a telephone combining such a peculiarly formed and arranged diaphragm

or armature with its other essential elements and operating parts.

In attaining the object of my invention, I take two or more substantially similar diaphragms and rivet them together at their centers. I then separate or spring them apart at their edges, and maintain such separation by the interposition of balls of suitably hard material, such as metal, or of other similar mechanical appliance which will allow radial movement of the diaphragms when subjected to vibrations in the usual manner, either by magnetic variation or by the impact of sound waves.

By way of illustrating the mechanical operation of the improvement we may profitably consider the difference in result when equal forces are applied to a bar and fagot of iron of equal size, respectively, for the purpose of bending them.

Let the homogeneous bar be one inch square, and one foot long, and let the fagot be composed of one hundred plates, each one hundredth of an inch in thickness, one inch wide and twelve inches long. It is evident while the magnetic permeability of the two objects will be about the same, that the bar will necessarily be extremely rigid and unyielding to the applied bending force, whereas the fagot will be relatively yielding, and will show itself to be vastly superior to the bar in point of mobility.

When we consider the case of a fagot as above, wherein the separate laminae are in contact throughout their entire length, it is obvious that a considerable amount of friction will be encountered when the said fagot is bent, owing to the sliding of each separate plate, over and upon the surface of its neighbors. If however the several plates of which it is composed be securely fastened together at their centers, and separated at their extremities by means of some medium which will allow of the separate longitudinal movement of each plate, a contrivance of great mobility will be secured, which yet will possess all the magnetic conductivity or permeability of a solid bar.

In some instances when my compound diaphragm is associated with a magneto tele-

phone, I reinforce the magnetic conductivity of the arrangement by means of a supplemental iron or steel plate which should be of a width suitable to be efficiently acted upon by, or to act upon, the magnetic poles exposed to its influence.

The same principles, which, applied to telephones, approve the construction of a compound diaphragm having its component plates centrally united, but flared at their edges, and provided there with supports which permit radial movement, may evidently be applied to the armatures of many forms of electromagnets, and it is obvious that a compound diaphragm is when associated with the magnet of a magneto telephone, itself an armature, and is properly so termed.

In the drawings which accompany and illustrate the invention, Figure 1 is a longitudinal cross section of a magneto telephone embodying my invention. Fig. 2 is a section on the line $y y$ of Fig. 1 looking toward the diaphragm which is partly broken away to more clearly show the radial supports. Fig. 3 is a central cross section of a variable resistance transmitter containing my invention; and Figs. 4, 5 and 6 are details thereof.

Referring to the type of instrument depicted by Figs. 1 and 2, B is the casing and C the cap piece of the telephone. They may be formed of any suitable material and united by a screw thread in the usual way, as shown, the latter having a cavity serving as a mouth or earpiece E with a central aperture k for the ingress and egress of the sound waves. M is the inducing magnet, in this case one with two active poles p , these being surrounded by helices or coils of wire c connecting by wires 2 and 3 with the screw terminals $w x$, and adapted thereby to be included in the telephone circuit. The space between the inner front surface of the cap piece and the shoulder o of the casing forms a chamber v of considerable depth within which the compound diaphragm D may be incased. I form this diaphragm of two plates $d d^2$ rigidly united at their centers, but spread apart at their edges as indicated. If desired, an armature i may be secured to the center of the inner surface of the diaphragm so as to be within the field of force of the magnet, and in that event the diaphragm plates are not necessarily formed of magnetic metal. Fitted within the chamber v are the devices which support the diaphragm. The edge of the inner diaphragm d^2 , may rest on the shoulder o of the casing, and the said supports are mounted in any desired way between the edges of the two plates forming the compound diaphragm, in such a manner that as it vibrates whether under the influence of sound waves, or of magnetic variation, its plates may slide over the said radial supports, whereby the before recited advantages are secured. These supports in the present instance consist of a number of balls b of any suitable material loosely held in holes made in the

web or flange f of a ring R, whose rim r is fitted within the chamber v . When the instrument is constructed as described, the space g in front of the compound diaphragm forms the usual vocalizing chamber.

In the application of my invention disclosed in Figs. 3, 4, 5 and 6, the diaphragm D is similarly made of constituent plates $d d^2$, and is contained within the other working parts within a casing B supplemented by a cap C having the usual mouthpiece E. The diaphragm is organized to control contact electrodes, or a variable resistance of any form, that shown being composed of a vibratory electrode V secured to the diaphragm center and a complementary electrode W in constant contact therewith supported upon an adjustable screw passing through the back of the casing. The said screw serves also as the binding post x to which the circuit wire 2 may be attached, and a second binding screw w is secured to the casing and is united internally by wire 3 to the diaphragm electrode and externally to the circuit wire 4. The supports differ in some respects from those of Figs. 1 and 2, being disk formed instead of spherical. The ring R has no inwardly projecting web or flange, but is provided with a number of pairs of hooks j . Between the two hooks of each pair is mounted a disk or wheel b^2 ; and these devices are placed at short distances apart, completely round the internal periphery of the ring and are mounted loosely on a circumferential wire or rod z which is supported in the bends of the hooks j . The operation of this form of instrument is not different from that shown in the former figures.

It is evident that though I have in the foregoing examples described a compound diaphragm formed of but two constituent plates, a greater number may if desired be employed; and that instead of considering them when secured together at their centers as forming a single appliance, they may with equal propriety be regarded as a plurality of diaphragms independent, though centrally united.

I claim—

1. A compound telephone diaphragm formed of a plurality of constituent plates united at their centers, and separated or sprung apart at their edges the said edges being free to move radially, substantially as described.
2. In a telephone, the combination of a compound diaphragm formed of a series of plates united at their centers, but otherwise independent, and bearing surfaces or supports for the edges of the separate plates which permit the free radial movement thereof, substantially as described.
3. The combination of a double or compound telephone diaphragm with free edges; and supports therefor, consisting of ball bearings interposed between the edges of the two members of the said double or compound diaphragm, substantially as described.
4. In an electro-magnetic instrument for

transmitting producing or reproducing sound,
a compound armature for an electro-magnet,
formed as described herein, of laminæ, cen-
trally united, and separated at their edges or
5 extremities in such manner as to permit free
and independent longitudinal movement.

5. An electrical speaking telephone com-
prising a magnet; helices surrounding the
poles thereof; a compound diaphragm or ar-
10 mature for the said magnet formed of two in-
dependent plates rigidly united at their com-
mon center but separated at their edges; a
flanged ring surrounding the said diaphragm;
and a number of balls seated in perforations
15 in the flange of said ring between the edges

of the said compound diaphragm and serving
as supports therefor.

6. In a telephone, the combination of a com-
pound diaphragm, composed of a plurality of
plates and anti-friction bearing surfaces sepa- 20
rating and supporting the edges of said plates,
substantially as described.

In testimony whereof I have signed my
name to this specification, in the presence of
two subscribing witnesses, this 4th day of 25
April, 1894.

STEPHEN D. FIELD.

Witnesses:

GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.