

UNITED STATES PATENT OFFICE.

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MONOTELEPHONE-RELAY.

1,014,220.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, PAUL HEINA, a citizen of France, residing at Paris, in the said Republic, have invented new and useful
5 Improvements in Monotelephone-Relays, of which the following is a specification.

This invention relates to modifications in the mono-telephone relay forming the subject matter of United States Patent No.
10 930,753, two of these modifications relating to the apparatus itself and a third to its operation.

The first modification consists in increasing the magnetic damping of the plate of
15 the relay when the latter is used for receiving short emissions.

In the accompanying drawings, Figure 1 is a side elevation and Fig. 2 a plan of the mono-telephone relay having the modifica-
20 tions forming the subject matter of the present invention. Figs. 3 and 4 are detail views, and Fig. 5 is a diagram of the electrical circuits.

The plate *a* which is made of material
25 adapted to vibrate, whether magnetic or not, has at its center an armature *b* of very pure soft iron and of a geometric form assuring the general symmetry of the ensemble of diaphragm and armature. This
30 armature, which is carefully constructed to avoid any residual magnetism, is of Lancashire iron annealed with wood and mounted on the shoulder of a conical piece of brass *c*. Above the shoulder, the piece of brass
35 extends through the steel plate *a* and receives the squared nut of brass or steel *d* for keeping the armature at the center of the plate. A nut *e* of hexagonal form and having a plain surface surmounts the nut *d*,
40 and a small plate *f* of a conducting and non-oxidizable alloy, such as an alloy of silver and platinum, is soldered to the nut *e*. This construction of the plate *a* is for the purpose of obtaining maximum sensitiveness
45 as well as rapid movement and rapid damping. In a plate thus constructed the acoustic characteristic constants of the relay given by the plate and the magnetic characteristic constants of the relay given by the
50 soft iron armature may be varied so as to separate the functions.

The relay is characterized, firstly by the acoustic constants which depend upon the dimensions of the vibration plate *a*, and
55 secondly, by the magnetic constants which

depend upon the dimension of the soft armature *b*. In other words, these constants define the relay very effectively, since experience has shown: that in a given circular diaphragm, vibrating for the first
60 sound harmonic and having an armature, the contact surface of which with the said diaphragm is a circle with a radius of less or at the most $3\frac{1}{2}$ mm., the corresponding
65 nodal line will be a circle, the diameter of which is smaller than $68/100$ of the diameter of the diaphragm. For instance, with a vibrating diaphragm of a diameter of 100 mm., the nodal line will have a diameter of less than 68 mm. This diameter de-
70 pends upon the weight of the armature and diminishes in proportion to the latter, but is subject to the following rule: The weight *Pe* of that part of the diaphragm which lies outside of the nodal line, and the weight *Pi*
75 of that part of the diaphragm which lies inside said line, are in a constant proportion equal to

$$\frac{Pe}{Pi} = 1,162.$$

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It is always possible to arrange an armature on a plate. The nodal line of the same in the first harmonic will be a perfect circle, under conditions stated above, that is when
85 the surface of contact is a circle with a radius of not more than 3-5 mm. It is always possible to figure out the diameter of the line, when the weight of the plate without the armature and the weight of
90 the armature are known, by recalling that the exterior and interior parts of the nodal line are always in the ratio 1, 162.

To adjust the plate *a* and the magnet parallel to each other there are screw threaded
95 rods *v* fixed in the movable platform *x* of the apparatus. These rods extend through the plate *a* and on them work nuts *u*. Between each nut and the plate is threaded on the rod a curved prism *z*, the knife edge of
100 which is in contact with the surface of the plate and the curvature of which is struck from the center of the plate. By adjusting more or less the nuts *u* on the threaded rods, the desired parallel position is ob-
105 tained.

The second modification relates to the arrangement of the lever *g* which is applied to the small plate *f*. This lever is centered on the standard *h* and at the end of its
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longer arm carries a piece *l* in which is mounted a plate *k* having a knife edge and of the same metal as the plate *f*; Fig. 3 shows a front elevation of the piece *l*. The shorter arm of the lever carries a screw-threaded rod *j* on which work nuts *i* constituting counterweights.

m is a screw for adjusting the height of the lever *g* and *n n* are screws for adjusting the orientation of the lever which is carried, as was described in the specification to United States Patent No. 930,753, in jeweled bearings designed to limit lateral play.

The longer arm of the lever comprises three parts, (1) the arm itself, *g*, which is a cylindrical metal rod; (2) the cylindrical conical piece of metal *l* mounted with light friction on the arm *g*, and (3) plate *k* riveted to the end of the piece *l* and of the same alloy as the plate *f*; this plate is ground to a knife edge, being for the purpose of obtaining as intimate a contact as possible between the knife and the plate. The grinding and polishing of these parts is performed with greatest care.

The third modification is for the purpose of avoiding deterioration of these contacts owing to production of sparks due to variation of intensity and consists in diminishing the effects due to self-induction which are produced in the circuit by application of a condenser, as shown diagrammatically in Fig. 5. The condenser is in shunt to the variable contact and the continuous current relay is provided with double windings, one of which is used for actuating the apparatus while the other is short-circuited on itself so as to diminish the self-induction of the winding traversed by the current, this arrangement producing an effect complementary to that of the condenser.

The maintenance of the knife edge *k* and the plate *f* parallel to each other may be secured by one or other of the following methods. (a). By turning the piece *l* on the arm *g*, which can easily be done by care-

ful adjustment of the screw *s* (Fig. 3). (b). By means of a metal piece *q*, which may be called a stirrup, mounted with considerable friction or fixed by a screw *p* on the arm *g*. This piece *q* carries two fine adjustment screws *r* (Figs. 1, 2 and 4) between which the piece *l* is placed so that by turning one or other of these screws the position of the knife *k* in respect to the plate *f* can be minutely adjusted. The apparatus thus constructed acts as a monophone plate of great magnetic damping, particularly applicable for very short emissions, such as those of wireless telegraphy.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is:

A mono-telephone relay comprising a plate of variable acoustic and magnetic properties and of great magnetic damping, an armature of soft iron of geometrical form assuring the general symmetry of the *ensemble* of plate and armature and devoid of all magnetism placed at the center of and at a certain distance from the said plate, a lever carrying at its end a knife made of an alloy which is a good conductor of electricity and non-oxidizable, a plate of like alloy, mounted on the first-named plate, and adapted to receive the said knife in contact with it and an electric circuit connecting the monotelephone relay with a continuous current relay comprising a source of continuous current, double windings one of which is used for actuating the printing apparatus, while the other is short circuited on itself, and a condenser shunted across the plate and the lever of the monophone relay.

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

PAUL HEINA.

Witnesses:

JULES FAYOLTET,
PIERRE FOSSARD.