P. E. HEINA.

MONOTELEPHONE RELAY TRANSFORMER.

APPLICATION FILED MAR. 24, 1908.

930,753. **Patented Aug. 10, 1909.**

2 SHEETS—SHEET 1.

Fig. 1

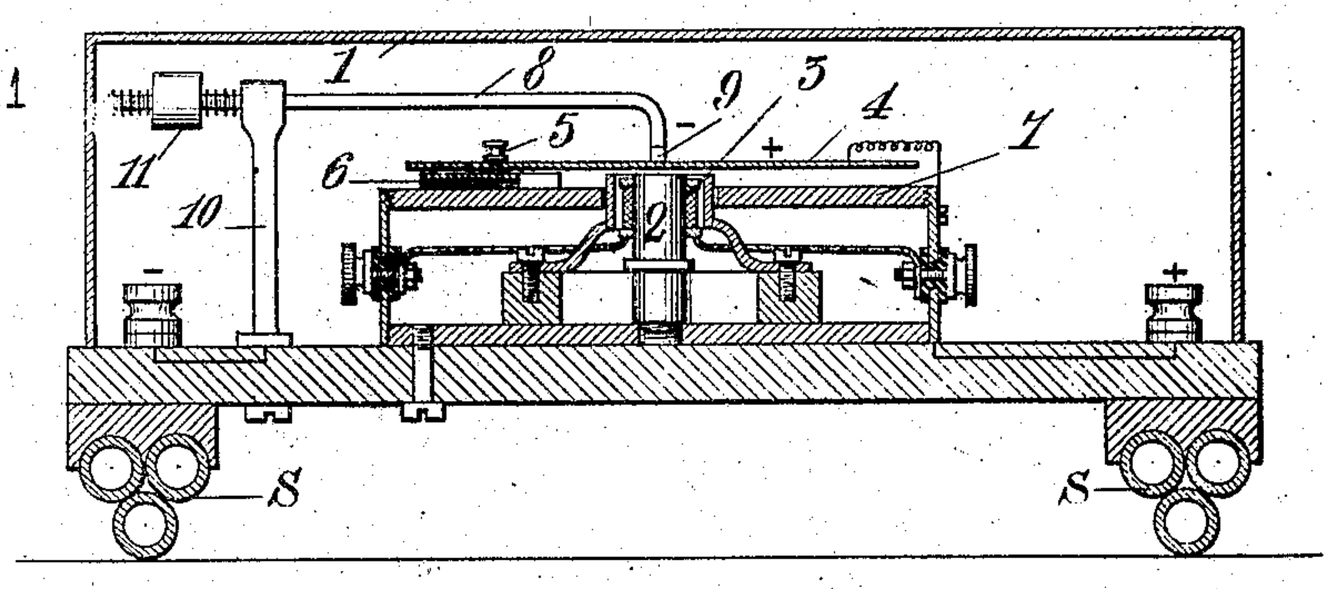


Fig. 2

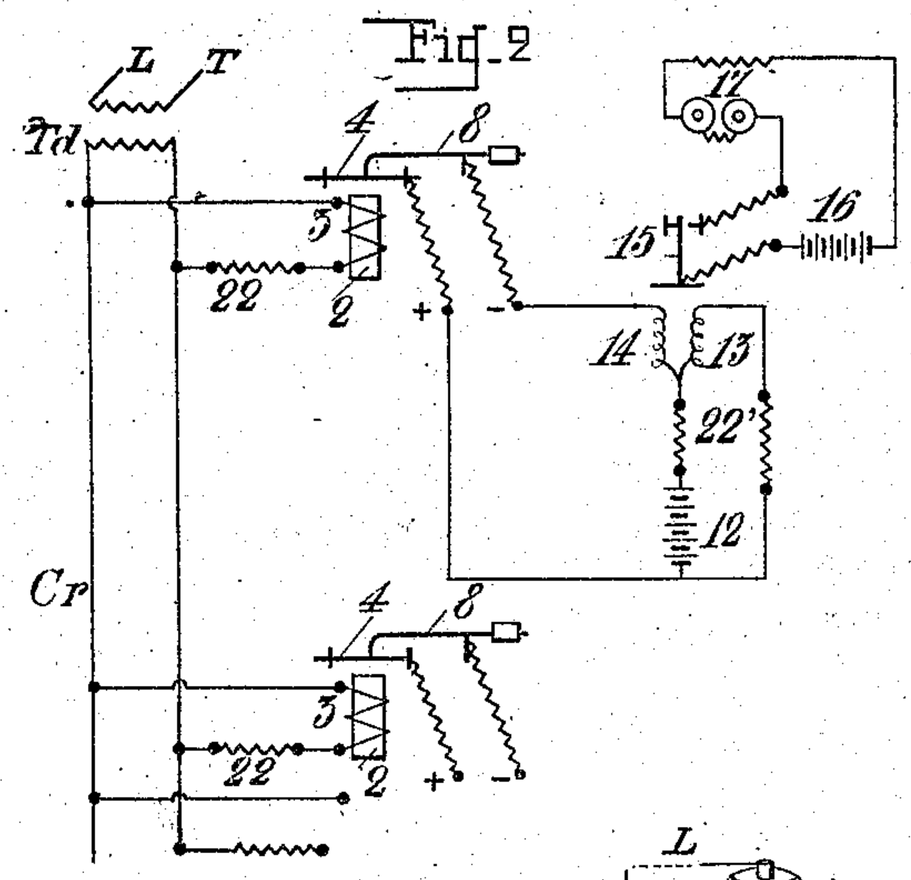


Fig. 4

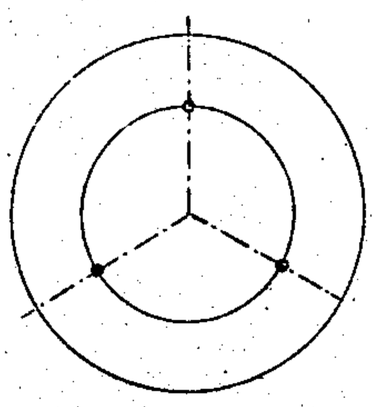
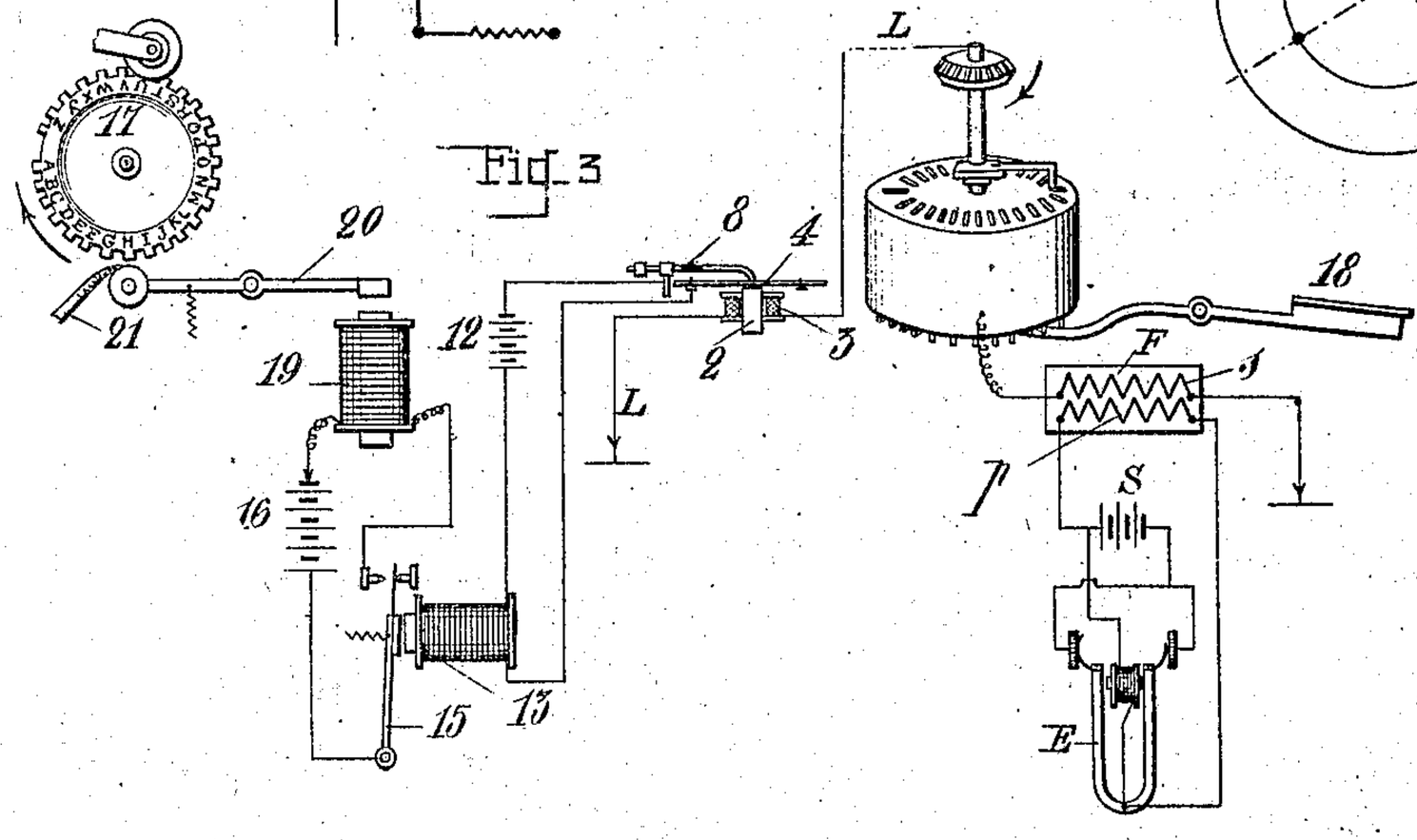


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 5

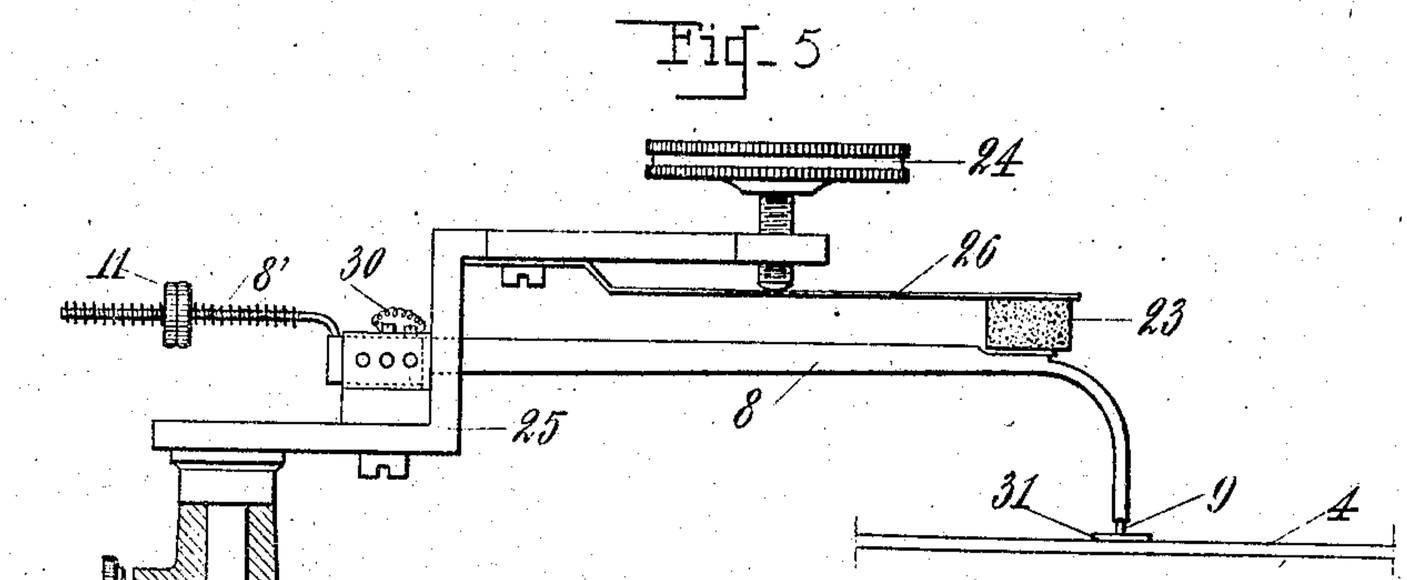


Fig. 6

Fig. 7

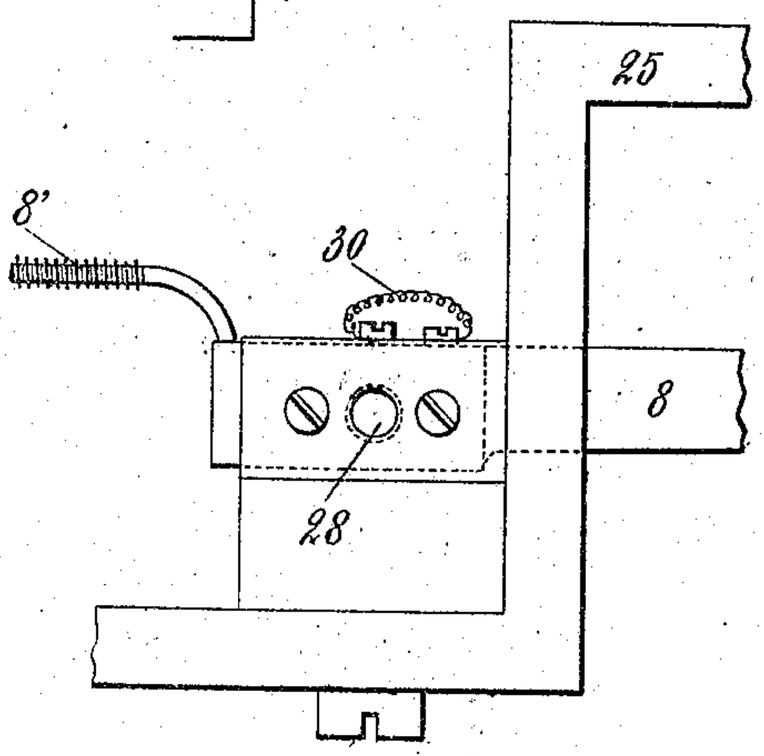
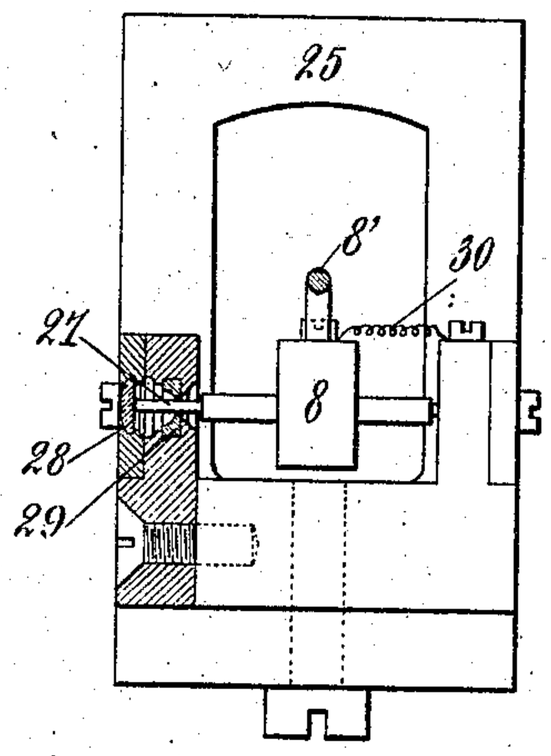


Fig. 8



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UNITED STATES PATENT OFFICE.

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MONOTELEPHONE-RELAY TRANSFORMER.

No. 930,753. Specification of Letters Patent. Patented Aug. 10, 1909.

Application filed March 24, 1908. Serial No. 423,064.

To all whom it may concern:

Be it known that I, PAUL EDOUARD HEINA, a citizen of France, residing at Paris, in the said Republic, have invented new and useful Improvements in Monotelephone-Relay Transformers, (for which I have obtained a patent in France, No. 376,155, bearing date March 27, 1907, and in Hungary, No. 41,093, bearing date April 6, 1907,) of which the following is a specification.

This invention relates to a mono-telephone relay transformer, which has a circular plate of magnetizable metal, the vibrations of which are used to produce variations in the equilibrium of the relay and to operate simultaneously several printing mechanisms of a receiving station in the same circuit and in both directions.

For the purpose of explaining the invention, the accompanying drawings show in Figure 1 a vertical section through the mono-telephone. Fig. 2 is a diagram illustrating the whole of the relay. Fig. 3 is a diagram illustrating the application of the invention to telegraphic printing mechanisms such as that known as the Hughes system. Fig. 4 is a plan of a mono-telephone plate. Fig. 5 shows in sectional elevation a modification of the equilibrium lever. Fig. 6 is a plan thereof. Figs. 7 and 8 are detail views drawn to an enlarged scale, showing in side elevation and front elevation respectively the arm carrying both the lever and its adjusting spring, the front elevation being partly in section on the line A—B of Fig. 6.

The same reference characters indicate the same parts in the various figures.

The mono-telephone relay transformer having a circular plate comprises a cylindrical box 1 mounted as shown in Fig. 1 on three rubber tubes S and containing an armature, of which the core 2 is surrounded by a coil 3 as in an ordinary telephone, but the mono-telephone diaphragm 4 instead of being incased around its periphery, is simply supported on three points at its nodal circumference corresponding with the first harmonic of its fundamental note, the supports being rods 5 fixed to slides 6 each adapted to be shifted along the radius of the circular platform 7 upon which they rest. The diameters of the diaphragms are determined in such a manner as to make for the first harmonic of the sound corresponding with the determined numbers n, n^2 . . . n^{12}, vibrations stepped from semitone to semitone. Each of the diaphragms is exactly in accord with a transmitter of alternating currents, for instance an electrically operated tuning fork E (Fig. 3), apparatus the construction and operation of which are well known. Under these conditions, when a series of periodical electric currents is passed through the coil 3, the period being equal to that of the first harmonic of the diaphragm 4, the latter resonates energetically while it remains almost unaffected if this period differs by a quantity corresponding with one-sixth of the note or less; thus the plate only reinforces a single sound. These mono-telephone relay transformers having circular plates are thus characterized by the sound of their first harmonic.

To transform the sound waves produced by one the relays whose plate vibrates under the influence of signals produced by periodical electric currents of the same period as that of the first harmonic of the plate, there is caused to rest upon the center of the plate the end of a lever 8 terminating in a platinum contact 9. This lever which may oscillate in jeweled bearings on a pillar 10 is adjusted by a counter weight 11 in such a manner that its speed of vibration may be slower than that of the plate 4 in order not to generate its own vibrations in the plate. When the coil 3 is traversed by a suitable periodic electric current and the plate 4 is thus made to vibrate the lever 8 can not follow these vibrations so that there is obtained between these two parts either an interruption or a variation of resistance. If the plate 4 and the lever 8 are respectively connected with the terminals + and − (Fig. 1) of a circuit of any suitable relay such as a differential relay 12, 13, 14 indicated in Fig. 2 the movable tongue 15 of this relay will be in equilibrium, when the lever 8 and the plate 4 are in contact, for it will not then be actuated by any current and in consequence the third local circuit, that of the battery or the like 16, in which are the printing mechanism of any suitable type, will remain open. If the equilibrium of the differential relay is modified in consequence of the variations of the contact between the lever 8 and the plate 4, the tongue 15 will close the circuit of the battery 16, that is to say, the printing mechanism will be operated when the corresponding plate is in vibration.

When all the transmitters at a transmitting station are at rest, all the generators of periodic electric currents are in movement

and all the plates 4 of the relay transformers are at rest at the receiving station. When a transmitter such as 18 (Fig. 3) is operated, the current generated in known manner in the secondary *s* of the transformer F is transmitted through the line L and passes through the coil 3 at the receiving station, thus setting up vibrations in the corresponding plate 4. These vibrations upset the equilibrium of the relay and the tongue 15 closes the circuit 16 of the printing mechanism 17, that is to say the electro-magnet 19 operates the lever 20 which presses the paper strip 21 on the printing disk.

Various devices are used to adjust the intensity in the relay transformer. For instance there can be intercalated in series with or in derivation to the coil 3 a rheostat 22, or the distance of the plate 4 from the core 2 may be varied; or the intensity in the differential relay operated by a continuous current and actuating the printing mechanism may be varied with aid of an adjustable rheostat 22′—inserted as indicated in Fig. 2. By such means, the apparatus is adjusted more or less. This adjustment may be effected without interrupting the receipt of the message.

Two of these mono-telephone relay transformers are shown diagrammatically in Fig. 2. In Fig. 1, 4 is the vibrating plate, 2 the polarized magnet and 8 the lever. The receiving circuit C—*r* which contains these transformers, is connected with the line L—T either directly or through a differential transformer T—*d*. It may be supposed that there are 12 mono-telephone relay transformers presenting successive steps of a semitone and connected in series in derivation or in a mixed manner. These apparatus are adjusted once for all; when once the tone of the plate 4 is determined, it does not vary more than that of the corresponding electrically operated tuning fork. The apparatus therefore do not require any adjustment in the course of use and superintendence is not required.

Figs. 5, 6, 7, and 8 show a modification of the construction of the oscillating equilibrium lever described above, this modification allowing exact adjustment of the lever and a hastening of its descent on to the contact at the ends of each vibration without sensibly increasing its pressure on the plate. For this purpose, the support of the lever is provided with an arm carrying a light adjustable spring which terminates in a very soft pad of felt; this pad bears upon the lever with an exceedingly light pressure such that the proper vibrations of the plate are not disturbed. The lever is mounted on a steel pivot turning in jeweled bearings so that owing to the absence of wear and the durability of the parts friction is reduced to a minimum. As before, 10 is the pillar supporting the lever, 8 is the lever, 11 its counter-weight and 4 the plate on the center 31 of which the lever rests. Instead of mounting the lever directly on the support 10 as in the previous case, it is carried by an arm 25 to which is also fixed a light spring 26 the tension thereof being adjustable by a fine adjustment screw 24 also carried by an arm 25; the spring 26 has on its free end a pad 23 of very downy felt of the kind known as the Pyrenese cloth; the threads of this pad exert very slight pressure on the lever 8. The parts 9 and 31 which come into contact with each other are preferably made of pure silver, the actual contact surfaces being burnished so that the metal may be as homogeneous as possible. The counter weight 11, instead of being mounted directly on an extension of the lever 8 is carried by a screw threaded rod 8′ mounted on the end of lever 8; the latter is supported on the arm 25 in the manner indicated on an enlarged scale in Figs. 7 and 8. The construction consists of a steel pivot 27, the ends of which turn in jewels 28 and which extend through jeweled bearings 29; wire 30 conducts the current from the mass of the apparatus to the lever.

Mono-telephones have been applied before only in such a manner that the signals are rendered audible at the receiving station, the Morse code being used, for example, but they have never been used before to serve for printing the messages at the receiving station by means of such printing mechanisms as the Hughes, Baudot or the like. This important result is obtained according to the present invention by means of the combination of the mono-telephone with the oscillating balance lever herein described, the equilibrium and mass of this lever being so determined that the number of oscillations proper to the lever is infinitely small relatively to the number of vibrations proper to the plate, so that the pressure exerted on the plate by the contact which determines the operation of the relay shall not interfere with the oscillations proper to the plate. The lever is so constructed that it makes two or three oscillations per second while the plate makes from 250 to 1000 vibrations in the same time.

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

1. A mono-telephone relay transformer comprising a circular plate of a magnetizable metal adapted to vibrate in known manner, under the action of periodic electric currents, three supports carrying the said plate and lying in the nodal circumference corresponding with the first harmonic of the fundamental note of the plate, radial slides carrying the said supports, and a lever adapted to

oscillate around a horizontal axis and balanced so that its speed of vibration is slower than that of the said plate.

2. A mono-telephone relay transformer comprising a circular plate of magnetizable metal adapted to vibrate in known manner under the action of periodic electric currents, three supports carrying the said plate and lying in the nodal circumference corresponding with the first harmonic of the fundamental note of the plate, radial slides carrying the said supports, a lever adapted to oscillate around a horizontal axis and balanced in such a manner that its speed of vibration is slower than that of the said plate, a support carrying the said lever, an arm mounted on the said support, a light adjustable spring mounted on the said arm, and a pad of very soft downy felt carried at the free end of the said spring and adapted to bear against the said lever with a very slight pressure.

3. A mono-telephone relay transformer comprising a circular plate of magnetizable metal adapted to vibrate in known manner, under the action of periodic electric currents, three supports carrying the said plate and lying in the nodal circumference corresponding with the first harmonic of the fundamental note of the plate, radial slides carrying the said supports, a lever adapted to oscillate around a horizontal axis and balanced so that its speed of vibration is slower than that of the said plate, a steel pivot carrying the said lever and jeweled bearings wherein the said steel pivot is adapted to turn.

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

PAUL EDOUARD HEINA.

Witnesses:
JULES FAYETTE,
EUGÈNE PICHON.