A. NIKIFOROFF.

SOUND INTENSIFIER.

APPLICATION FILED NOV. 21, 1907.

920,624.

Patented May 4, 1909.

Fig. 1.

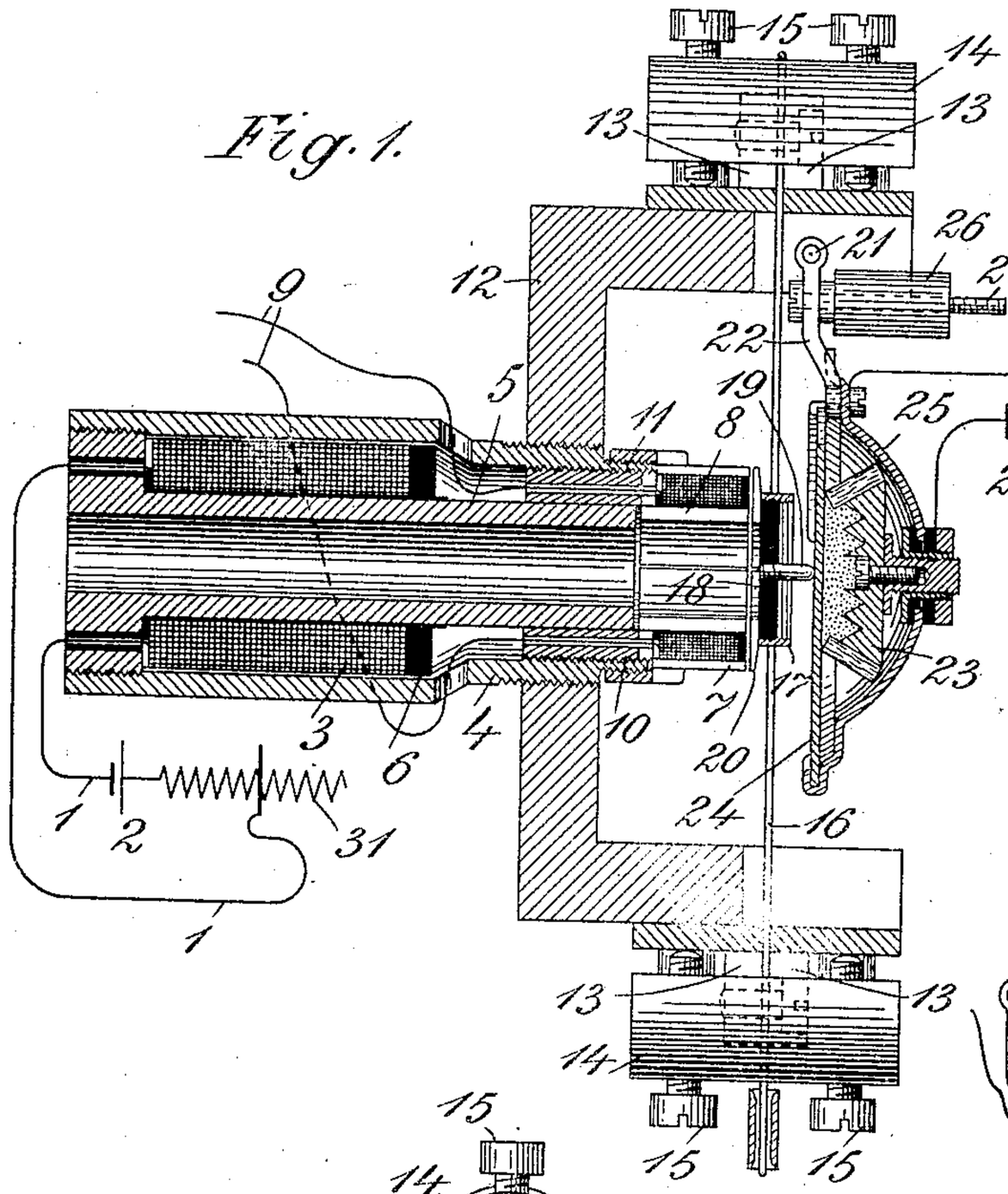


Fig. 2.

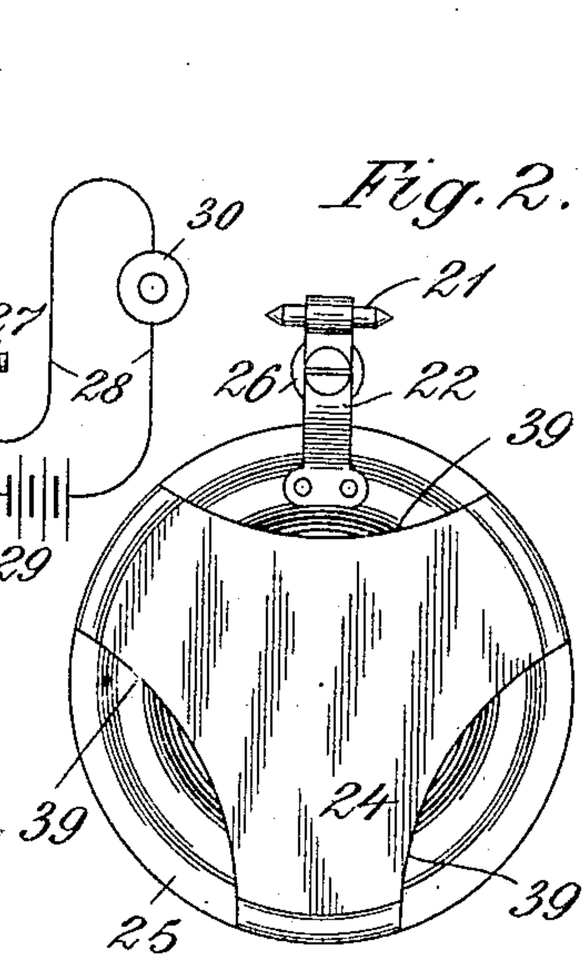


Fig. 3.

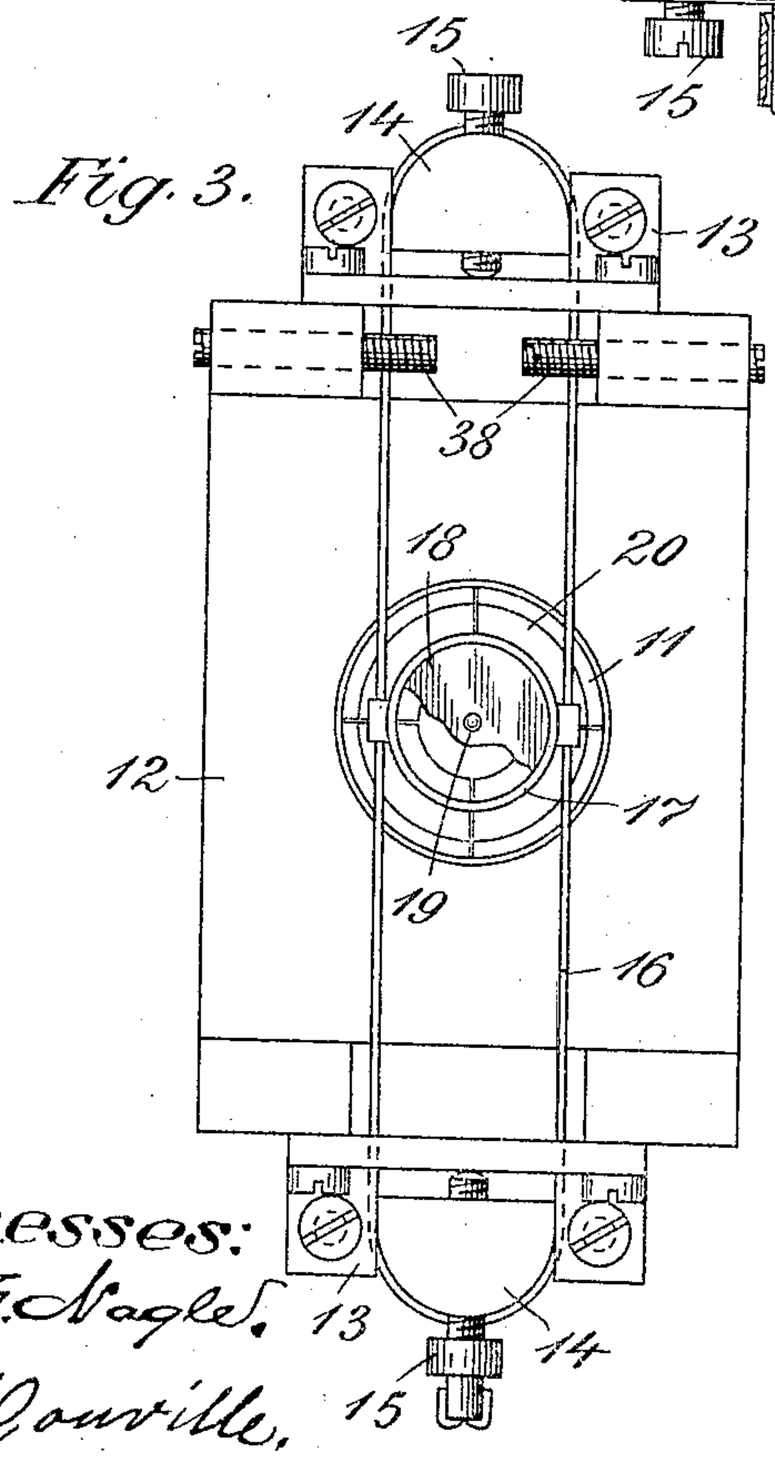


Fig. 4.

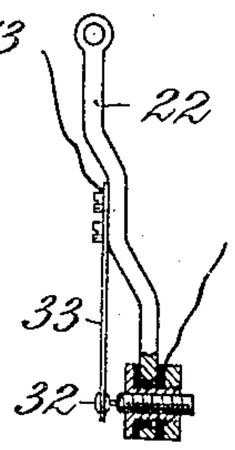


Fig. 5.

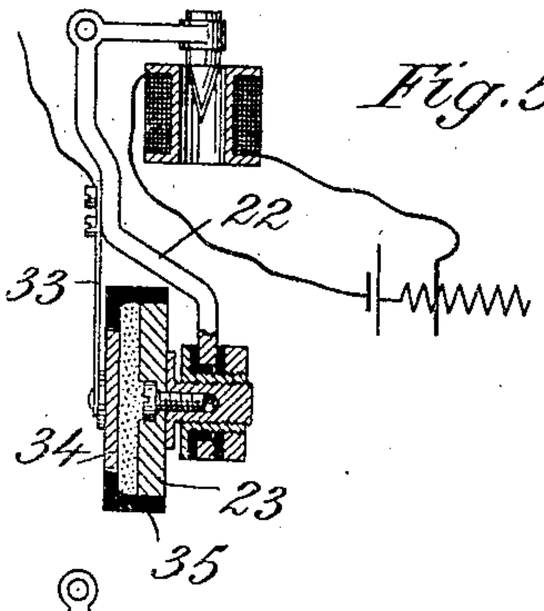
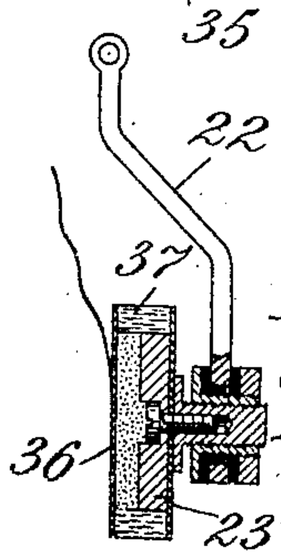


Fig. 6.



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UNITED STATES PATENT OFFICE.

ALEXANDER NIKIFOROFF, OF WARSAW, RUSSIA.

SOUND-INTENSIFIER.

No. 920,624. Specification of Letters Patent. Patented May 4, 1909.

Application filed November 21, 1907. Serial No. 403,181.

To all whom it may concern:

Be it known that I, ALEXANDER NIKIFOROFF, functionary, a subject of the Emperor of Russia, residing at Marszalkowska 36 W. 3, Warsaw, Russia, have invented new and useful Improvements in Sound-Intensifiers, of which the following is a specification.

My invention relates to an electric sound intensifier more particularly adapted for telegraphy and telephony, both on the wire and wireless systems.

It has reference generally to means for amplifying telephone currents and feeble alternating currents of variable frequency.

Prior electric sound intensifiers have consisted of appliances not more sensitive than a telephone receiver, and have been such that it has only been possible to intensify relatively strong currents with them With my new invention, on the contrary, even currents too weak to be heard in a telephone receiver can be intensified to any desired extent. As is well known, the receiver has been regarded as the most sensitive apparatus existent within the range of small current electrotechnics.

According to my invention an annular armature is carried by a stretched loop and is under the influence of hollow concentric pole pieces separated from the polarization source by an air-gap containing a magnetic field, the said armature by means of a pin acting upon an electrically independent microphone is held automatically in contact with it, the microphone diaphragm or membrane being suitably damped by the aforesaid pin.

Exhaustive experiments have shown that by means of this appliance sounds, such as music and conversation, can be very essentially magnified. The new apparatus can also be used, for instance, for intensifying alternating currents of various frequencies, such as are employed in wireless telegraphy and telephony, etc., when the sounds transmitted are not sufficiently well heard, or are not loud enough to perform mechanical work.

My invention is illustrated in the accompanying drawing, in which—

Figure 1 is a longitudinal section through a form of construction of the new apparatus. Fig. 2 is a front elevation of the microphone. Fig. 3 is a front elevation of the apparatus, the microphone being removed. Figs. 4, 5 and 6 show modifications of the microphone device.

The construction shown in Figs 1—3 is the result of practical experiments, but it must be understood that I in no wise desire to restrict myself to such, since the principle of the invention can be employed in various ways.

Referring to Fig. 1, the polarizing circuit 1, which contains a source of electricity 2 (such as a single cell) is connected to the ends of the coil 3 of a so-called iron-clad or bell electromagnet, consisting of two concentric hollow poles 4, 5. To hold the coil 3 a vulcanite or other suitable ring 6 may be employed. Opposite the ends of the poles 4, 5 there are located the hollow poles 7, 8 (each divided longitudinally into four parts in order to prevent the formation of eddy currents) of a second magnetic device. The distances between the ends of the poles 4, 5 and those of the poles 7, 8 can be regulated. The line-circuit 9 is connected to the coil of the hollow pole magnet 7, 8, the wires being advantageously conducted through perforations in a brass ring 10. For securing the segments of the four-part hollow poles 7, 8 a screw collar 11 is employed, to receive which the pole 4 is terminally threaded. The collar is soldered internally to the pole 7, and the pole 5 is soldered at suitable places to the brass ring 10. Opposite the outer end of the poles 7, 8 is located the movable part of the magnet system, consisting of a vibrator, diaphragm or the like. In Fig. 1 a so-called vibrator is shown. The device may be carried by a brass yoke 12, screwed or otherwise secured to the pole 4. At the top and bottom of the yoke 12 there is secured a bracket having two lugs 13 which serve to guide a sliding member 14, which can be raised or lowered as desired by means of set-screws 15. The slides 14 are rounded outwardly and serve to hold a wire loop 16 having the shape of an elongated O. This loop is provided centrally with a brass ring 17 having a disk 18 of diamagnetic material. This disk 18 is provided with a pin 19 of steel or other hard material, directed outwardly and having a rounded end. The brass ring 17 carries an iron armature 20 of several, for example four segments. The number of armature segments corresponds with that of the number of the poles 7, 8, the division into segments being for the

purpose of avoiding the formation of eddy currents. Against the rounded end of the pin 19 there bears with a certain regulable pressure the movable part of a microphone. This part is shown as a diaphragm in Figs. 1 and 2, but may be in the form of a spring or otherwise, such for instance, as shown in Figs. 4, 5 and 6.

The microphone case shown in Fig. 1 is mounted to oscillate on an axis, located in the top part of the yoke 12, so that the case may come into contact with the vibrator of the magnet system automatically. The arrangement may advantageously be such that studs 38 are screwed through cheek-pieces of the yoke 12 and provided with small depressions or "pops" to receive the "centers" or points of a short axis 21 (Figs. 1 and 2). Pendent from the latter is an arm 22, which carries the microphone case 25. The microphone is of the well-known granulated carbon type, the carbon particles being contained in a suitably shaped carbon slab 23 at the bottom of the case 25. The slab is surrounded by a felt or other suitable jacket having the form of a hollow truncated cone, whose outer edge lies against the carbon or like suitable diaphragm 24, secured in the case, and, as already mentioned, rests against the rounded end of the steel pin 19. The space between the diaphragm and the carbon slab 23 is filled with carbon granules in well-known manner. The slab 23 is insulated from the case 25 in any suitable way. In order that the pressure with which the diaphragm 24 bears upon the pin 19 may be regulated, a screw spindle 27 may be provided at the top of the arm 22, and a counterweight 26 furnished upon the spindle, so that by screwing this weight in one direction or the other, the pressure of the diaphragm can be adjusted. The conductors 28, leading to a telephone receiver 30 of any ordinary description, may be connected to the case 25 at any suitable parts. In the receiver circuit a cell or battery 29, or any other well-known source of electricity is connected.

If a current is sent through the electromagnet 4, 5, it polarizes the poles 7, 8. This polarizing effect can be altered as may be necessary by the one end of the wire 1 being moved over a reducing rheostat 31, so that accordingly as the end 1 lies more or less to the right or left, more or less resistance is cut into the circuit and in consequence the attractive force, or degree of polarization of the magnet 7, 8 altered.

The apparatus is set in action by the line current, which flows through the coil of the hollow pole-pieces 7 and 8 whereby the trembler and thereafter the movable part of the microphone is set in action. By the novel arrangement the effect of the current is increased by reason of the coil being inclosed between the two concentric pole-pieces, which are separated from the polarizing source by an air gap. The formation of eddy currents is prevented on account of the above mentioned construction and of the total division or splitting up of the pole pieces as well as of the armature.

The construction of the present sound intensifier is the result of the researches of the applicant in the domain of electro-magnetism which demonstrated—

1. That the polarization of the magnetic system of a relay cannot be maintained absolutely constant. Thus the vibrator will constantly alter the pressure upon the microphone system unless both come into contact automatically.

2. That a magnetic flux selects its path and predominates near the contours of the pole piece section.

3. That the distribution of the lines of force in the magnetic field of a coil preeminently takes place near the contours or outlines, essentially owing to the fact that a part of the flux passes through the copper and thus practically disappears.

Instead of the regulating weight 26, especially when very great accuracy is required, an electromagnetic device might be employed for the microphone case also. This device might consist of an iron core secured to an arm, and of a solenoid embracing the same (Fig. 5); alteration in the intensity of the current flowing to the solenoid can then be effected by inserting more or less resistance in the circuit, in well-known manner. In this way the diaphragm of the microphone will be pressed with more or less force against the pin 19. The advantage of this method is that the pressure of the diaphragm can be regulated from a distance, which is much more convenient than having to adjust by hand, as regulation must be effected during operation of the apparatus.

The microphone diaphragm may be replaced by a wire loop, whose construction corresponds with that of the vibrator of the magnet system. In order that the diaphragm may be rendered more sensitive, it may be cut away circumferentially at 39 (Fig. 2), so that it can be more readily bent. The apertures at 39, moreover, promote air circulation and thus aid in cooling the diaphragm, which, as is well-known, becomes hot during working.

The pin 19 may naturally be secured to the movable part of the microphone instead of to the vibrator of the magnet system. It should also be remarked that the microphone diaphragm requires no damping, such as is necessary with ordinary microphone cases, for damping is effected by the pressure of the pin.

In the modification shown in Fig. 4 the arm 22 is furnished in front with an arm 33 carrying a small hammer 32, which may con-

sist of platinum, carbon, metallic oxid, etc. Opposite the hammer is a contact of the same materials.

The spring 33 of the modification illustrated in Fig. 5 carries a carbon disk 34, which is loosely set in a case 35 of insulating material, in which the slab of carbon 23, usual in ordinary microphone cases, is inserted, together with the usual carbon particles. The space between case and slab is sufficiently small to prevent the very minute granules of carbon from falling out of the case. The modification shown in Fig. 6 is similar, but a carbon disk 36 is employed, adhesively attached to a felt ring 37. No spring is necessary in this case.

A single device of the above description is sufficient to greatly intensify the smallest sounds or current impulses, which can be heard in the best receiver, but the effect can naturally be increased as required by the employment of a number in common.

Having thus described my invention, what I claim as new is:—

1. In an apparatus for intensifying telephone and like electric currents and alternating currents of variable frequency, the combination of an annular armature, a pin fixed to said armature, a stretched loop carrying said armature and pin, concentric hollow pole-pieces acting upon said annular armature and forming a magnet system excited by the currents to be amplified a polarization source the said pole-pieces being each separated from the polarization source by an air-gap containing a magnetic field, and a microphone system influenced by the armature through the medium of said pin, but freely suspended and electrically independent of the said pin, substantially as set forth.

2. An electric sound intensifer, comprising a magnet system possessing concentric hol low poles and presenting a movable part consisting of an armature and a stretched wire loop carrying the same; and a microphone having a movable part bearing with a certain regulable pressure against the said movable part of the magnet system; substantially as described.

3. In an apparatus for intensifying telephone and like electric currents, the combination of a polarization source comprising two hollow and concentric poles excited by a current capable of regulation, a magnetic system consisting of two hollow and concentric poles inclosing between them the coil receiving the line current, the said poles, which are separated from the source of polarization by an air gap, which contains a magnetic field, being completely divided longitudinally, and of a vibrator formed of a stretched wire loop carrying a radially divided or split annular armature arranged in front of the said poles and being provided with a central pin for transmitting vibrations to a microphone system which is automatically damped by the pressure of the said pin, substantially as set forth.

In witness whereof I have hereunto signed my name this fourth day of November 1907 in the presence of two subscribing witnesses.

ALEXANDER NIKIFOROFF.

Witnesses:
HERNANDO DE SOTO,
WITOLD FUCHS.