Feb. 2, 1926. 1,571,368

H. CHIREIX

RELAY

Filed August 29, 1921 2 Sheets-Sheet 1

Fig. 1

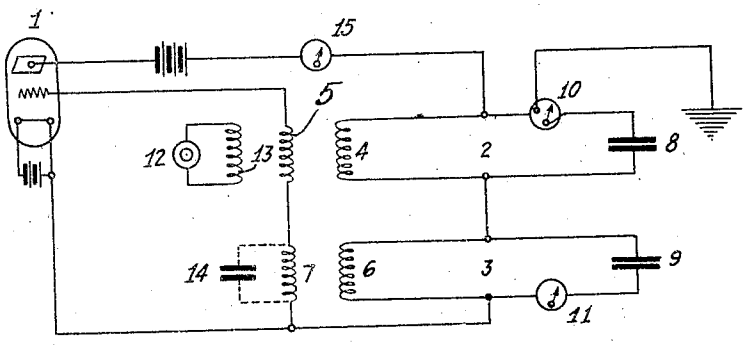
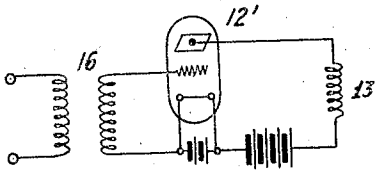


Fig. 2



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Feb. 2, 1926. 1,571,368

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Filed August 29, 1921 2 Sheets-Sheet 2

Fig. 3

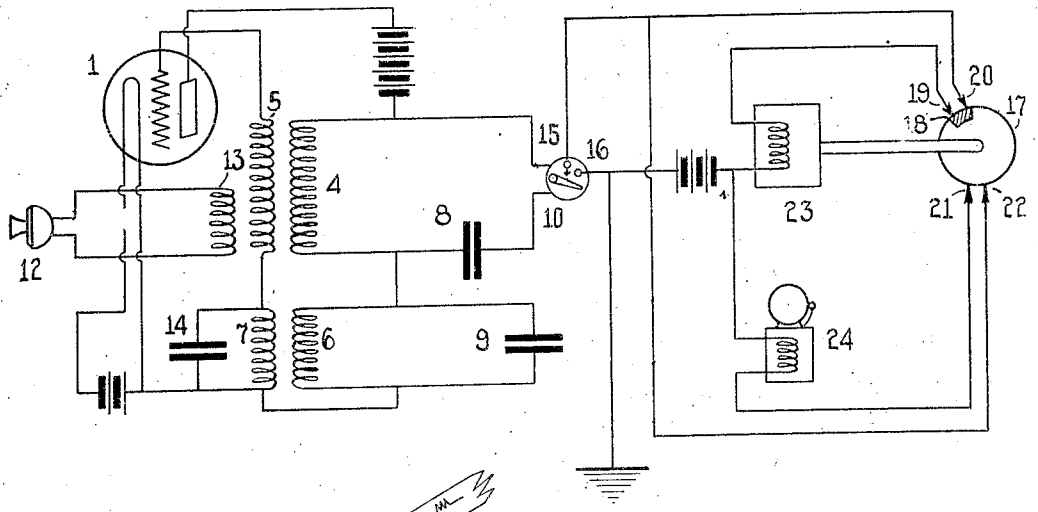


Fig. 4

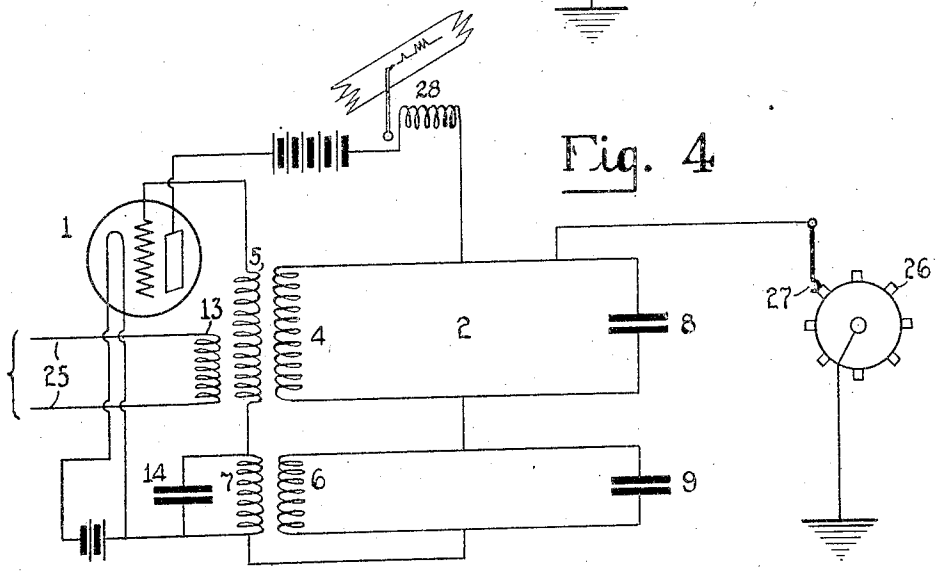
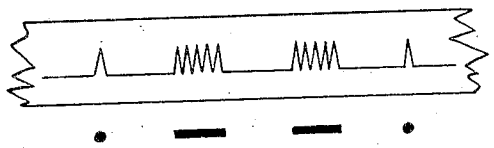


Fig. 5



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Patented Feb. 2, 1926. 1,571,368

UNITED STATES PATENT OFFICE.

HENRI CHIRRIX, OF PARIS, FRANCE.

RELAY.

Application filed August 28, 1921. Serial No. 493,667.

To all whom it may concern:

Be it known that I, HENRI CHIRRIX, a citizen of the Republic of France, and a resident of Paris, France, have invented certain new and useful Improvements in Relays (for which I have filed an application in France August 18, 1920), of which the following is a specification, accompanied by drawings.

The present invention relates to the provision of a sensitive relay for voice or alternating currents of weak intensity. It does not relate to an amplifier, i. e. an apparatus reproducing in an amplified manner the vibrations transmitted thereto, but to an apparatus that closes a contact under the control of voice or electrical vibrations transmitted thereto.

It has been found that, if a three-electrode vacuum tube operates as an oscillation generator and may strike a plurality of different oscillation frequencies (by means of circuits having a plurality of different oscillation frequencies) only that oscillation will become effective to which the system presents the strongest negative resistance.

The invention comprises a three electrode tube provided with two oscillating circuits arranged in such a manner that, oscillations corresponding to the two different frequencies of the system, may be produced with substantially equal facility. In this manner, an unstable system will be produced. By connecting a microphone or the like to the terminals of a self-induction coil which is coupled with one of these oscillating circuits, the action of the voice which modifies the current induced into the microphone, will be sufficient to suppress the oscillation corresponding to one of the frequencies of the circuit, and to introduce the oscillation corresponding to the second frequency.

In the present invention, the effect of the external influence is to change only the frequency of the oscillations generated by the vacuum tube. If the frequencies of the two circuits are sufficiently different, practically only one oscillating circuit will contain current at a time, and this circuit will be the one having a natural frequency near to that of the wave sent out.

This arrangement may also be used in different ways for actuating a relay. In one form, a testing lamp may be provided in each oscillating circuit. When one starts talking into the microphone, one lamp is lighted and the other extinguished.

In another arrangement a device is placed in one of the circuits that performs the functions of a relay, e. g. an ammeter (thermic or electrodynamic) carrying a contact arranged to close the circuit of another relay of any suitable type.

In still another arrangement direct current apparatus, such as an ammeter or relay, is provided with contacts inserted in the supply circuits of the plate of the vacuum tube. In this case, the circuits would be arranged in such a manner that, the two liberated oscillations correspond to materially different power absorbed from the supply. In this manner, the voice will produce a sudden variation in the plate current.

It should be noted that, after once produced, the phenomenon remains, and in order to convert the oscillation back to the first frequency, intervention is necessary. Notwithstanding this, the conditions may be regulated in such a manner that, after the cessation of the action, the conversion back to the first frequency is automatically produced, but that is not the general case.

It may however be desirable not to repeat the phenomenon. If, for instance, the final effect is to actuate a bell, this will stop only when the operator again strikes the first oscillation.

Generally, slight operations are sufficient for this purpose. Such operation would be e. g. to ground for a short time one point of the circuit, whereby a shunt path is provided for the high frequency currents through the capacity of the source. This ground connection may be immediately interrupted, because the first oscillation has started and persists, it being a well-known experimental fact that, an oscillation once generated persists, even when conditions are such that it would not start.

The pointer of the contact apparatus may very well perform this operation. In this manner, an arrangement is produced in which there is one oscillation frequency almost continuously that gives a strong current in one oscillating circuit and a negligible current in a second circuit, and from time to time, (only when the microphone is actuated), there will be a second oscillation frequency giving a strong current in the second oscillating circuit and a negligible cur-

rent in the first circuit. This second oscillation frequency has only a duration that is equivalent to the time the contact takes to close, the effect of such closure being to provoke the generation at the first of the two frequencies of the system.

My invention is illustrated by way of example in the accompanying drawing, in which,

Fig. 1 shows an arrangement according to my invention;

Fig. 2 shows a modification thereof;

Fig. 3 shows an arrangement according to my invention adapted to cause the energization of a bell or the like;

Fig. 4 shows an arrangement of my invention adapted to operate as a signal recorder and

Fig. 5 shows a record of signals produced by the apparatus shown in Fig. 4.

Fig. 1 is a diagram illustrating one embodiment of the invention. In this figure, 1 is a vacuum tube serving as an oscillation generator. The plate circuit of this tube comprises two oscillating circuits 2 and 3 that are coupled, respectively, with the grid circuit through the mutual induction coils 4 and 5, on one hand, and through 6 and 7, on the other hand. The oscillating circuits 2 and 3 include also variable condensers 8 and 9 and ammeters 10 and 11 the operation of which is adapted to cause the closure or opening of the external circuits. Only the ammeter 10 is shown in the drawing as arranged to cause the closure of such circuit, i. e. the ground connection of the oscillating circuit 2 provided for the automatic striking of the oscillatinons corresponding to the idle position of the apparatus. Through the agency of the coil 13, a microphone 12 when actuated by the voice impressions causes the generation of oscillations corresponding to the operating condition of the apparatus.

The constants of the generator tube oscillation circuit are so chosen that the generator will produce one of two radically different frequencies with equal facility. The circuit 2 is tuned to one of these frequencies and the circuit 3 to the other. When the generator is oscillating at one frequency, therefore, there will be a heavy current circulating in circuit 2 and no appreciable current in circuit 3 and when the generator is oscillating at the other frequency there will be a heavy current circulating in circuit 3 and practically none in circuit 2. The generator will be self-excited by the action of either the coupling 4—5 or the coupling 6—7, depending on the oscillation frequency. If oscillations corresponding to the frequency of circuit 2 are started the generator will be self-excited by the coupling 4—5 and these oscillations corresponding to the frequency of circuit 2 will be sustained. If, however, the microphone 12 begins to vibrate its resistance will undergo large instantaneous changes and, as it is coupled to the circuit 2 through the coupling 4—13, these variations in resistance will serve to change the inductance and apparent resistance of circuit 2. These changes are sufficient to prevent the self-excited generator from further sustaining oscillations corresponding to the frequency of circuit 2. They are not sufficient, however, to prevent the generator from acting as a self-excited generator of oscillations corresponding to the frequency of circuit 3. The tube will, therefore, cease to operate as a self-excited generator of oscillations of the first frequency and will start to operate as a self-excited generator for oscillations of the second frequency.

The changes in the resistance of the microphone have no appreciable effect on the coupling 6—7, as it will be noted that the coils 5 and 7 are in series in the grid circuit of the tube and the impedance of the tube between its grid and filament is sufficiently high to prevent any appreciable current flow in this circuit. The action of the coupling 6—7 as means for self-exciting the tube is, therefore, independent of any operation of the microphone.

As soon as the oscillations die out in circuit 2, the needle of the ammeter 10 will move to its zero point and close a circuit placing a ground on circuit 2. The ground connection has the effect of placing a condenser in parallel with the condensers 8 and 9. The constants of the generator plate filament circuit are, thus, again changed so that the conditions of self-excitation of the generator are no longer satisfied for the frequency of circuit 3, but continue to be satisfied for self-excitation of the generator for oscillations corresponding to the frequency of circuit 2. The tube will, then, again start to oscillate at the frequency of circuit 2, a large current will again start to flow in circuit 2 and the needle of the ammeter will open the ground connection. Then oscillations will continue until the diaphragm of the microphone again starts to vibrate.

A capacity, such as the one shown at 14, may be provided to useful advantage between the terminals of the coil 7. The purpose of this capacity is to facilitate the tuning of the oscillations. Generally speaking, any circuits or circuit details may be adopted for the connection of the vacuum tube, without departing from the spirit of the invention. The purpose of the arrangement is to operate the tube at two different frequencies (shunt connection, capacity, etc. between the plate-grid circuits).

The desired effect of the relay may also be obtained by means of an ammeter 15 provided in this case in the plate conductor itself. Advantage is taken of the difference in the intensity of the current supplied by

the plate battery depending on whether the tube oscillates at the first or second frequency. If constructed in this manner, the apparatus may be put to various uses and particularly as a signaling system for wireless telegraphy. The arrangement shown in Fig. 3 or any analogous arrangement may be used for such purpose: the microphone 12 is coupled with the telephone receiver of a wireless telegraph receiving system (not shown) tuned to the signals to be received. For the purpose of providing protection against grinders or atmospheric disturbances, the operation may proceed in the following manner;

The sending of the first signal at the sending station actuates the contact apparatus 10. The latter through contacts 15, 16, closes the circuit of a first relay 23 which starts the rotation of a wheel 17 controlled by a clockwork. This wheel will immediately open the circuit of the first relay through movement of conducting sector 18 away from contacts 19 and 20, and will close after a predetermined time and for a very short time through contacts 21 and 22 and sector 18, the circuit of a second relay 24 that is also under the control of the contact apparatus. If at this very time, a second signal is sent from the sending station, the second relay will be actuated, and may in turn actuate, e. g. a bell. If desired, for the sake of greater security, this second relay may free a second wheel which closes a third circuit upon the expiration of a predetermined time corresponding to the sending of a third signal from the sending station, etc. If the signals received by means of the telephone do not follow the desired sequence, the indicating apparatus will not operate.

This arrangement may also be used to register the signals. In this case as shown in Fig. 4, the contact apparatus should be constituted by a small very fast relay 28 adapted to carry the stylus. The regeneration of the original oscillation will be performed by a small wheel 26 operated at a uniform rate, and arranged periodically to establish the above mentioned ground connection through contact 27.

The operation will proceed in the following manner:

(1) The sending station does not send signals; the first oscillation frequency remains and the periodic contacts of the wheel have no influence whatever.

(2) The sending station sends a dash, the first oscillation frequency is suppressed and the second oscillation frequency starts. The stylus traces a dash of short duration, and the periodic contact regenerates the first oscillation frequency. The stylus traces a second dash in the inverse sense.

If the wheel has a sufficiently fast movement, the dash still lasts at this time, and the same phenomenon is reproduced. Finally, the stylus will have performed a plurality of complete oscillations during the duration of a dash.

(3) The sending station sends a dot. The phenomena follow in the same manner, but the stylus performs only one or two complete oscillations during this time.

A record such as would be traced by my apparatus is shown in Fig. 5.

Thus far, the assumption has been made that the actuating medium is a microphone. However, the operation may be carried on also if an alternating current relay is used. In this case, an alternating tension is applied between the grid and the filament of the three-electrode tube.

The microphone may also be replaced by any apparatus that performs the function of a variable resistance. A magnetic amplifier or the space between the plate and the filament of a second three-electrode tube is particularly adapted for this purpose. In the latter case, the current of weak intensity creates a difference of potential between the grid and the filament of the tube. As a result of this, the resistance of the absorbing circuit is modified and the relay actuated. Obviously, the energizing current may in this case be a direct current. The circuit 12, 13 of Fig. 1 is replaced by the circuit 12', 13 (Fig. 2) in which 12' is a three-electrode tube the grid circuit of which is actuated, e. g. through the agency of a transformer 16, by the energizing current of the relay.

Having described my invention what I claim is:

1. A relay for electric currents comprising an oscillation generator having two generating frequencies, means actuated by said currents for suppressing one of said frequencies and causing the generation of the other and contact means adapted to be actuated by the changes in the output of the oscillation generator.

2. A relay for electric currents comprising a three electrode vacuum tube generator having a circuit tuned to respond to either of two generated frequencies, means actuated by said currents for suppressing one of said frequencies and causing the generation of the other, and contact means adapted to be actuated by the changes in the output of the vacuum tube.

3. A relay for electric currents comprising an oscillation generator having an output circuit comprising two sections tuned to different frequencies, means actuated by said currents for suppressing one of said frequencies and causing the generation of the other frequency, contact means adapted to be actuated by the changes in the currents in one of said sections and a ground connec-

tion to one of said sections adapted to be interrupted by said contact means.

4. A relay for electric currents comprising an oscillation generator having an output circuit comprising two sections tuned to different frequencies, means actuated by said currents for suppressing one of said frequencies and causing the generation of the other frequency in the other section, and contact means actuated by the change in the currents in one of said sections for restriking the first frequency.

5. A relay for electric currents comprising an oscillation generator having two generating frequencies and means responsive to speech, for suppressing one of said frequencies and liberating the other in accordance with said speech.

6. A relay for electric currents comprising an oscillation generator having two tuned currents corresponding to an idle and an operating frequency, signalling means for suppressing said idle frequency and liberating the operating frequency in accordance with said signals and means for automatically restoring the generator to liberate the idle frequency.

7. A relay for electric currents comprising an oscillation generator having a circuit tuned to respond to either an idle or an operating frequency, means actuated by said currents for suppressing one of said frequencies and liberating the other, contact means adapted to be actuated by said change in the currents generated, means for periodically restoring the generation of the idle frequency and indicating means actuated by the contact means.

8. A relay for electric currents comprising an oscillation generator having two generating frequencies, a source of power, said generator being adapted to generate either of said frequencies in accordance with the power supplied by said source, and signalling means adapted to be operated by said currents for varying the power supplied to the generator, thereby liberating the desired frequency.

9. A relay for electric currents, comprising a vacuum tube generator, a battery connected thereto, said generator having circuits adapted to generate either of two frequencies, depending on the power supplied to the generator, and a microphone actuated by said currents adapted to change the power supplied by the battery.

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