(No Model.)

F. VAN RYSSELBERGHE.

HARMONIC TELEGRAPHY.

No. 400,523. Patented Apr. 2, 1889.

Fig. 1.

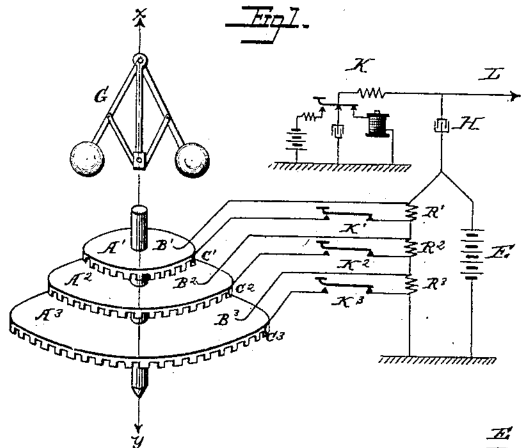


Fig. 2.

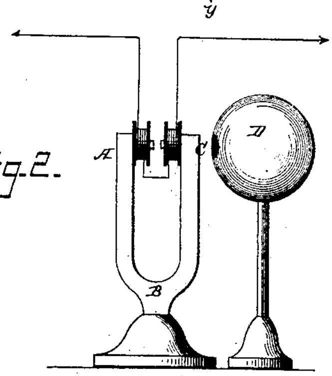


Fig. 3.

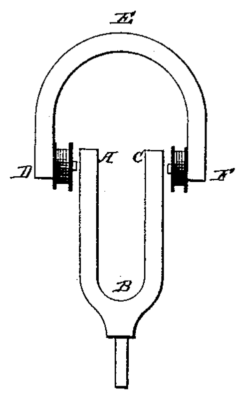
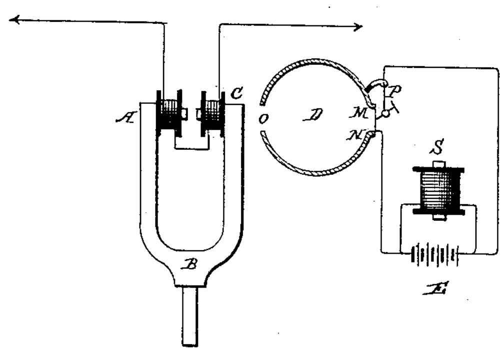


Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANÇOIS VAN RYSSELBERGHE, OF BRUSSELS, BELGIUM, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HIMSELF, AND THE PHONO-MULTIPLEX TELEGRAPH COMPANY, OF BALTIMORE COUNTY, MARYLAND.

HARMONIC TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 400,523, dated April 2, 1889.

Application filed September 8, 1886. Serial No. 213,028. (No model.)

To all whom it may concern:

Be it known that I, FRANÇOIS VAN RYSSELBERGHE, a citizen of Belgium, residing at Brussels, Belgium, have invented new and useful Improvements in Harmonic Telegraphy, of which the following is a specification.

My invention relates to improvements in harmonic telegraphy; and it has for its object to enable a large number of separate and independent telegraphic messages to be sent simultaneously over a single wire either in the same or in opposite directions; and in order to carry out my invention I have made certain new constructions and adaptations of the transmitting and receiving instruments and their arrangement with relation to each other and the ordinary Morse or other line; and my invention consists in these improvements, which are more particularly pointed out hereinafter.

In the accompanying drawings, Figure 1 is a diagrammatic representation of an embodiment of my improvements in the transmitter. Figs. 2, 3, and 4 are similar representations of receiving devices.

Heretofore it has been necessary to maintain a constant relation or proportion between the numbers or rates of vibrations produced and sent by the different transmitters, and these proportions have been those which exist between the musical tones or notes of the musical scale. It followed from this that the operators working the phonic transmitters were never independent of each other. It has also been necessary to have the several receivers tuned and vibrated in exact unison with the corresponding transmitters.

Many attempts have been made to construct and arrange a practical harmonic or tone telegraph system and to overcome the objections above referred to, as well as many other difficulties which need not be mentioned. In order to overcome these troubles and to produce a practical tone-telegraph, I have made several improvements in the apparatus both at the transmitting end and the receiving end of the line, and I will now point out more particularly the improvements in the transmitter end, whereby I am enabled to transmit or send to the line a series of vibrations which always bear a constant and invariable relation or proportion to each other, without adjustment by the operators, and which maintain these various rates uniformly. I provide a single rotating axle with several permanently constructed and arranged circuit-controlling wheels—as, for instance, such as are indicated in the drawings—consisting of cog-wheels having suitable brushes bearing thereon, and each tooth making or breaking contact with one of the brushes as the wheel rotates, the number of makes and breaks produced at each rotation of the various circuit-controlling wheels being prearranged according to the number of electric vibrations, undulations, or changes of potential in the line to be produced by the various wheels. The number of changes of electric potential in the line produced by each wheel or other device being thus arranged to bear a position and invariable relation, I provide the rotating axis or the motor driving the same with a governor that will always maintain the rotation of the circuit-controllers at a constant and invariable rate or speed. In doing this I make use of an isochronic motor or regulator, and preferably one which I have found to be quite perfect, that is described in an application for patent filed this day and serially numbered 213,027.

Referring to the diagram shown in Fig. 1, an axis, X Y, which may be driven by any suitable motor, carries a number of circuit-controllers (shown in the present instance as three cog-wheels, A' A^2 A^3) electrically insulated from each other, and brushes B' B^2 B^3 are arranged to permanently contact with the respective wheels, while the brushes C' C^2 C^3 only touch the teeth as they pass successively by the respective brushes. Attached to the rotating axis, or otherwise connected to the motor which drives it, is an isochronic governor, G, which controls the axis, maintaining a uniform speed thereof, and it is represented in the diagram by an ordinary ball-governor for purposes of illustration, though, of course, it is well known that such a governor does not produce isochronous movements. The battery or other source of electro-motive force E is here shown in one branch of the line, in another branch of which is a series of resistances, R′ R^2 R^3, each of which may be short-circuited through the respective wheels and brushes by closing the corresponding key, K′ K^2 K^3. A condenser, H, is shown as being interposed between the battery and main line L, and by this arrangement it will be seen that the tone or harmonic telegraph may be used in connection with an ordinary Morse or other usual form of telegraph, K, the currents of which are preferably rendered gradual in their emission and extinction, so as not to affect the phonic receivers in a manner pointed out in my Patent No. 320,987. With the arrangement as thus indicated, the axis being rotated at a uniform rate of speed, if one of the keys is closed the corresponding resistance will be shunted each time a tooth of the corresponding wheel comes in contact with the brush, and each shunting will create a corresponding change in the electric potential upon the line through the inductorium or condenser, if such be used. Now, suppose the three keys shown to be closed together and the wheel A′ to be provided with thirty-two teeth or contact-pieces, the wheel A^2 with forty-eight pieces, and the wheel A^3 with seventy-two pieces, which numbers are in the proportion of 4 6 9, and suppose the wheels, for instance, rotate four times a second. It will be evident that the closing of the key K′ will create one hundred and twenty-eight electric variations in the line-wire, the closing of key K^2 will create one hundred and ninety-two, and key K^3 two hundred and eighty-eight vibrations per second. It will be seen that the numbers of these electric vibrations will always bear the same relations to each other—namely, the proportions of 4 6 9—and it happens that they will correspond to the musical tones of do′ sol′ re^2, and these three tones will exist simultaneously and electrically upon the line-wire, and, their relations being uniformly maintained, they will not interfere with each other in the least.

It is evident that the same number and uniform rate of vibrations may be produced by increasing the number of contacts in the wheel and decreasing the rate of rotation, or vice versa, as it always happens that no matter what the rate of rotation of the axis may be the variations in the current produced by the circuit-controllers always maintain the same relation to each other. The same principle apparently may be carried out with a greater number of circuit-controllers moving in exact synchronism. In order to receive these tones separately and without interference from each other, I make use of a receiving apparatus, which I will now describe. In Figs. 2, 3, and 4, A B C represent a magnetized tuning-fork, the fundamental note or tone of which corresponds to one of the circuit-controllers of my phonic transmitter. In the form shown in Figs. 2 and 4 the tuning-fork itself is a magnet, the legs forming the poles thereof, and each branch is provided with an electro-magnet, the coils of which are included in the line-wire. In the form shown in Fig. 3 the fork itself is not necessarily magnetized; but the magnet D E F, having a coil connected to the line-wire on each of its ends, is arranged in proximity to the tuning-fork, so that the legs thereof act as armatures to the magnet. Any electric tone or set of electric variations coming over the line will cause the fork to vibrate, even when such tone is not in unison with the fundamental tone of the fork. In other words, the fork may be said to act to a certain extent as an ordinary telephone responding to every note or tone; but its vibrations under such circumstances are weak, and it is only when the electric tone or variations are in unison with the fundamental note of the fork that they are strongest. If the fork is supported upon a non-resonant body or is insulated by sound-deadening material, the sounds other than those in unison with the fork will be hardly perceptible; but the sounds that are in unison will be clearly heard and understood. I have also found that if a non-magnetized fork is used the sounds produced thereby are comparatively weak, and when the fork is once put into vibration it continues to vibrate even after the current has ceased, and the dots and dashes or other signals required for use in phonic telegraphy cannot be distinguished. When, however, the fork is magnetized, as above set forth, the signals are rendered sharp and distinct and clearly distinguishable.

In order that the signals may be more distinctly heard and understood in each separate receiver and to further aid in suppressing all but the desired tone in connection with each fork, I make use of an improved form of what is known as a "Helmholtz Spherical Resonator." It is essential to make a distinction between such a resonator and the ordinary sounding-board or other resonators—such as prismatic boxes. These latter respond not only to the fundamental tone, but to the harmonics thereof, and while such sounding boards or boxes increase every sound the spherical resonator responds only to one tone or fundamental note and tends to suppress all other tones. The resonator consists of a hollow ball with one or more holes in it, and the single note to which it will respond depends upon the diameter of the ball and the holes. When such a resonator is arranged in conjunction with the improved fork above described, the fork and resonator respond loudly each time the fundamental note or tone is sent through the wire and are silent to all other sounds. The resonator should be mounted upon a base separate from the tuning-fork.

In Fig. 4 I have shown one of the openings of the resonator covered with a diaphragm, M N, and a pendulum, P, bears upon the diaphragm, shunting in short circuit the coil or relay S, in circuit with the local battery E, and when the diaphragm is vibrated by the fork the pendulum is moved, making bad contact with the diaphragm, and the battery puts the relay into operation.

I have thus set forth my invention as embodied in certain forms of devices and arrangements of circuits; but it is evident to those skilled in the art that various modifications in both may be made without departing from the essential principles thereof, and I have not deemed it necessary to illustrate such arrangements or to describe them more fully.

I do not herein claim any features shown and claimed in my Patent No. 370,577.

I am aware of Patent No. 365,103, and make no claim for the features of invention claimed therein.

I claim—

1. In a tone or harmonic telegraph, the combination, with a rotating axis and a number of independent circuit-controlling wheels mounted thereon, normally out of circuit, of a number of brushes making contact with the wheels, a normally-open branch circuit for each wheel, and a key for closing each branch, substantially as described.

2. The combination, with a rotating axis, of a number of circuit-controlling wheels mounted thereon and insulated therefrom and from each other, a normally-open branch circuit for each wheel, and a key for closing each branch, substantially as described.

3. The combination, with a rotating axle and a number of insulated circuit-controlling wheels mounted thereon, of a branch circuit, including a series of resistances, and a shunt-circuit around each resistance, including one of the circuit-controlling wheels, substantially as described.

4. The combination, with a rotating axle and a number of circuit-controlling wheels mounted thereon and insulated therefrom and from each other, of normally-open branch circuits, including the wheels, a key for closing each branch, and an isochronic governor regulating the rotation of the wheels, substantially as described.

5. The combination of a magnetized tuning-fork, and one or more electro-magnets connected in the line-circuit for operating it, and a spherical resonator arranged in juxtaposition to the magnetized fork, substantially as described.

6. The combination, with a resonator, one end of which is covered with a diaphragm, of a pendulum in contact with the diaphragm, a battery, and a circuit, one branch including the diaphragm and pendulum and the other branch including a sounder, substantially as described.

F. VAN RYSSELBERGHE.

Witnesses:

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S. FURTENAKEL.