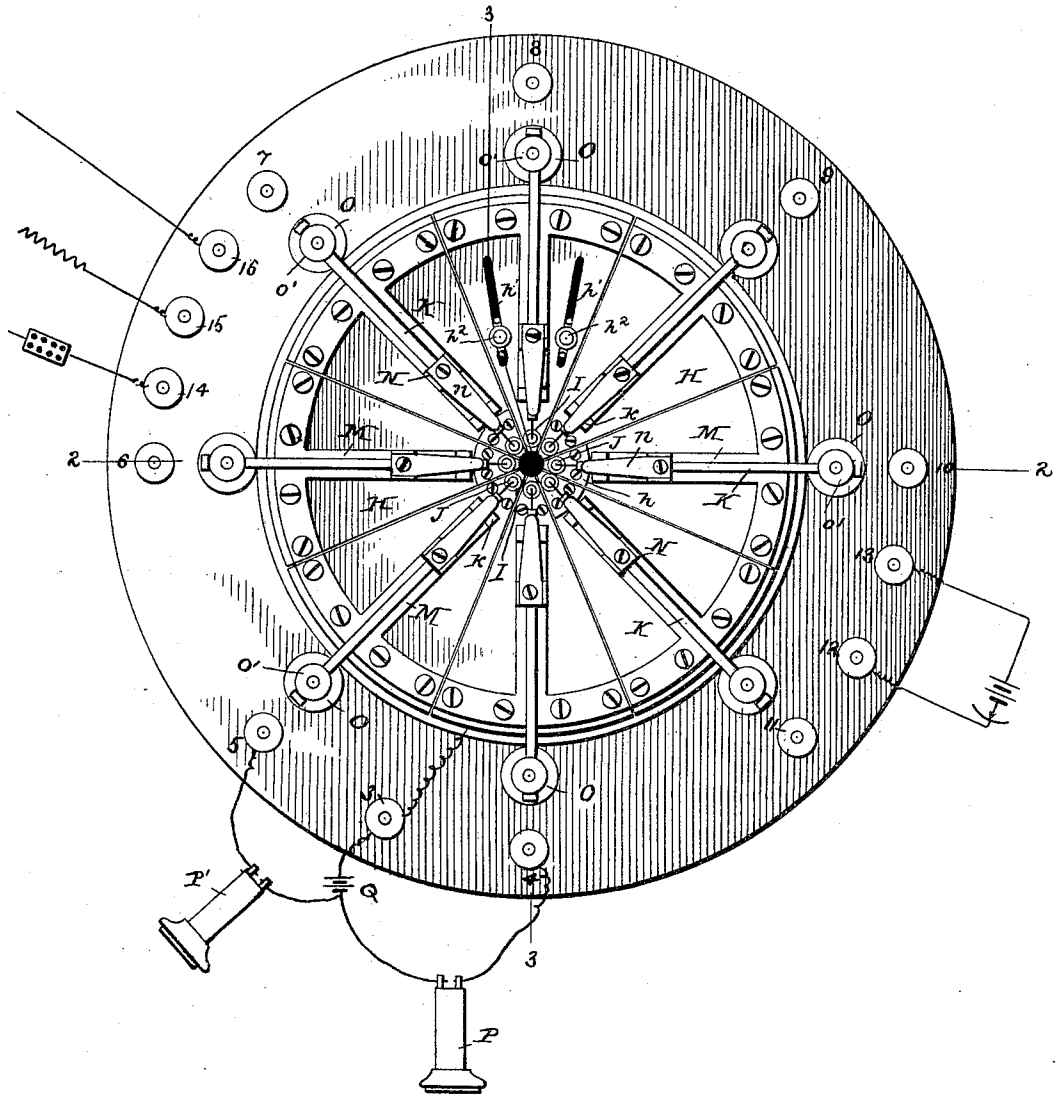
(No Model.) 2 Sheets—Sheet 1.

F. VAN RYSSELBERGHE.

HARMONIC TELEGRAPHY.

No. 409,157. Patented Aug. 13, 1889.

Fig 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

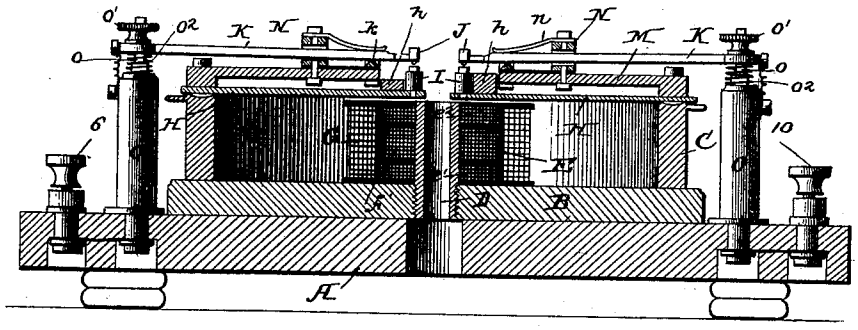


Fig. 3.

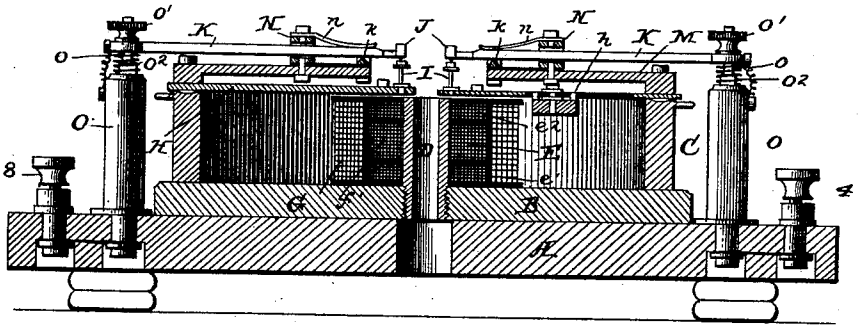
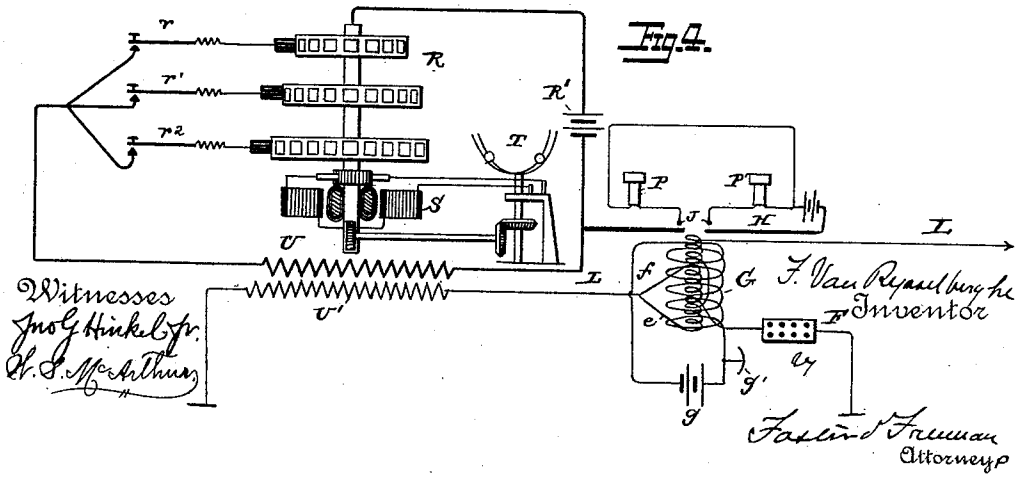


Fig. 4.



UNITED STATES PATENT OFFICE.

FRANÇOIS VAN RYSSELBERGHE, OF BRUSSELS, BELGIUM, ASSIGNOR TO THE PHONO-MULTIPLEX TELEGRAPH COMPANY, OF BALTIMORE COUNTY, MARYLAND.

HARMONIC TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 409,157, dated August 13, 1889.

Application filed July 26, 1888. Serial No. 281,077. (No model.)

To all whom it may concern:

Be it known that I, FRANÇOIS VAN RYSSELBERGHE, a citizen of the Kingdom of Belgium, residing at Brussels, Belgium, have invented a certain new and useful Improvement in Tone or Harmonic Telegraphy, of which the following is a full, clear, and exact specification.

My invention relates to tone or harmonic telegraphy, and more especially to apparatus designed for use as receiving-instruments in connection with such system, though my present invention may be used as a transmitter under some conditions; and it has particular reference to a system substantially such as is described and patented to me in United States Letters Patent No. 370,577. In the practical use of such systems of telegraphy, especially when it is desired to employ but a single-line circuit for the transmission of a large number of messages and to a great distance, it is necessary to have delicate and at the same time positively-acting instruments to serve as receivers, it being understood that each receiver is intended to respond to one only of a number of transmitters which may be superposing on or sending over the same main line varying series of electrical impulses or changes of electric potential at the same time.

It will be understood that the problem to be solved is to provide receiving apparatus which when connected to the circuit shall be capable of separating the various series of signals which are simultaneously coming over the line, and to render each series of signals independent and distinct from all other signals, so that each operator will be able to clearly understand the particular message being transmitted to him, and to be free from interruptions or disturbances from the other messages which may be on the line, or from the effects of induction or other disturbances consequent upon the practical use of such a telegraph system. Many attempts have been made to practically solve this problem, and they have resulted in greater or less success, and the object of my present invention is to furnish a simple and effective arrangement of devices which shall fully overcome these difficulties and supply a thoroughly practical and commercial instrument that may be used for a multiplicity of messages without interference with each other or from external causes.

Referring to the accompanying drawings, which illustrate one embodiment of my invention, Figure 1 is a top plan view. Fig. 2 is a transverse section of the same on the line 2 2. Fig. 3 is a similar sectional view on the line 3 3. Fig. 4 is a diagrammatic representation of the circuits.

As generally used heretofore, it has been common to arrange a number of receiving-instruments in connection with the main-line circuit, each receiving-instrument being provided with its own magnet, through which the line-current is obliged to pass, and the number of electro-magnets in the line-circuit is thus equal to the total number of receivers. It is well known that an electro-magnet, owing to its own induction, offers a considerable resistance to the flow of the electric current, and this is especially noticeable in systems of this character where rapid electric impulses are passing over the line, and it results from this arrangement that the strength of the current passing through the magnets is weakened by being obliged to pass through the coils of a number of receivers connected in a line.

Another disadvantage in the use of separate magnets for each receiver in this class of instruments is found in the difficulty of properly balancing the line when the telegraph is intended to work as a duplex or quadruplex system, as each coil has to be made exactly equal to all the other coils, and this requires exceedingly careful construction and adjustment, and besides is expensive. In my present invention I overcome these difficulties by making use of but a single magnet and coil to operate all of the receiving devices, and I so arrange the circuit-controllers about this coil that each and every one will be operated thereby. While this idea may be carried out in different ways, in the present instance I make the circuit-controllers in the

form of sectors and arrange them about a single magnet the coil of which is in the main line.

In carrying this out, upon a suitable base A is placed a magnet B in the form of a circular disk having an annular rim C, forming one polar extension, and a hollow core D, centrally arranged with regard to the rim, forming the other polar extension, and the coil E of the main line is wound around the core D, preferably differentially; and in the present instance I have shown the branch *e* of the line L as wound on a coil *e'* and then on the coil e^2, passing thence to the main line, and the other branch *f* arranged to form the coil *f'*, and passing thence to ground through the artificial resistance forming the artificial line F. By this winding it will be observed that the outgoing currents at any station will not affect the receiving-instrument, the branches of the main line neutralizing each other's effect in the coil, while currents coming from the distant station will pass through but one of the branches and operate the receiving-instrument in a manner well understood by those skilled in the art. While such an arrangement as this has been found effective, I prefer to establish a magnetic field about the core of the receiving-instrument, and to accomplish this I wind over the coils of the main-line wire a supplementary coil G of coarse wire, which is connected with a local battery *g* in the local circuit having a galvanometer *g'*, and by this means I am enabled to produce a constant magnetic field in the magnet, which is varied by the signals coming over the main line through the finer-wire coils, and I have found the signals to be more sensitive and delicate and clear cut than when the local circuit is not used to produce a constant field.

Secured to the annular rim or pole C are a number of sectors H—eight being shown in the present instance—and the points of these sectors are symmetrically arranged around and in inductive relation to the core D. From this arrangement it will be seen that whenever a change of potential occurs in the coil of the magnet all of these sectors will be influenced thereby to a greater or less extent; but it is to be understood that these changes of potential are made by some transmitting-instruments which produce them in a certain regular and predetermined order, and it is necessary to construct and arrange these sectors H so that each one shall respond properly to some one of the predetermined order of signals coming over the line. This result may be accomplished in various ways—as, for instance, by making the sectors of different thicknesses, as clearly shown in Figs. 2 and 3, or by weighting them at or near their points by attaching blocks, as *h*, of various sizes, as indicated in Fig. 2; or, again, by providing slots *h'*, in which are arranged adjustable blocks or weights h^2, by which the normal rate of vibration of the sectors may be delicately determined; or sometimes it is preferable to use all of these methods combined; or I may make use of any other well-known expedient to accomplish this result. Mounted upon each of these sectors at or near their points is a pin or contact-piece I, which of course will move with the sectors when they are vibrated under the influence of the current.

While the various signals may be read and understood from the vibrations of the sectors themselves, I prefer to utilize the vibrations of the sectors to control local circuits, including suitable receiving-instruments, as by this means not only can the signals be more distinctly heard and understood and the disturbances due to induction and other false signals overcome, but they may be separated and conveyed to different localities to the operators or users, so that subscribers or renters may make use of the telegraph in their various offices and each be independent of the operations of all the other local circuits. In the arrangement shown these local circuits are made to include contact-pieces J, which are arranged in proper relation to the contacts I on the sectors, and are each mounted on a lever K, fulcrumed at *k* on an arm M, secured to the rim of the magnet. This arm M is shown as being a rigid metallic arm extending from the rim toward the center of the magnet, and which forms a part of the means for holding the sector to the rim of the magnet, and also serves to securely clamp the sector by means of the screws passing therethrough. Mounted upon this arm M is an adjustable sliding piece N, having a passage through it to allow free play of the lever K, and provided with a spring-finger *n*, which is arranged to bear upon the lever K and maintain it upon its fulcrum, and it may also be adjusted so as to bias the lever or counterbalance the longer arm thereof. This long arm of the lever K is shown as embracing a stud *o* on the standard O, and is regulated by a thumb-screw *o'* and a spring o^2. The tension of the spring is such in the present instance that the contact-pieces I J are normally held in contact thereby, and by turning the thumb-screw *o'* an exceedingly fine adjustment of the contact-pieces can be made, as it will be observed that the relative proportions of the arms of the lever are such that considerable movement on the long arm will produce a very slight one on the shorter arm.

While I have thus specifically described a preferred form of contact-adjustments, it is evident that my invention is not limited to this precise arrangement, although I deem it necessary to provide some means that are substantially the same, whereby I can produce an exceedingly sensitive and accurate adjustment. This feature is essential in adjusting the apparatus, so as to prevent inter-

ference with the various receiving devices from induced currents or other disturbing causes.

It is well known that any current (no matter what be the order of the makes and breaks) passing through the magnetic coils will affect to a greater or less extent all the sectors and cause some vibrations therein; but it is also well known that these vibrations will not reach their full amplitude unless the makes and breaks or changes of potential in the current are at certain regular intervals corresponding with the pitch of the particular sector to be affected. It is this principle which enables me to so adjust the receiving apparatus that it shall not be materially affected by induced currents and the like, which would tend to produce false signals in the receivers, and this I accomplish by so adjusting the contacts that the local circuit shall not be closed through them except when the sectors are vibrated under the influence of proper currents. In other words, the contacts are "adjusted over" the induced-current effects, and are still within the range of the vibrations when the sectors are properly vibrating. This feature not only enables me to overcome the effects of induced currents, but enables me to more clearly differentiate the numerous receiving devices and to so adjust the parts that signals intended for one sector will affect that sector only sufficiently to produce the signals in the local circuit of that sector, and while they will affect all the others they will not so affect them as to cause a closure of the contacts and thereby produce signals in the other circuits.

While various forms of receiving-instruments may be used in these local circuits, I preferably make use of an ordinary magneto-telephone P, as this instrument is peculiarly adapted to operating in this connection, and gives clear-cut signals, which are readily distinguished and not liable to mutilation.

I have shown in the accompanying drawings a way of arranging all the local receiving-instruments in a single circuit, in which Q is the battery, one pole of which is connected to the binding-post 3 and thence to the rim C of the magnet, and of course the current passes through the particular contact-piece I to the corresponding contact-piece J, the lever K to the post O, and thence by the binding-posts 4, 5, &c., of the particular telephone back to the other pole of the battery Q.

From the above description the operation of my device will be readily understood, and I have shown in Fig. 4 a diagram illustrating one way of connecting it up in a telegraph-circuit. In this figure R represents a circuit-breaker operated by a motor S and controlled by a regulator T. R′ is the battery of a local circuit having three branches, including keys r r' r^2, each having a brush bearing upon one portion of the circuit-breaker R and all connected with the primary coil U of the induction-coil. It will be understood that when either one or all of the keys r are closed a corresponding series of interruptions are produced in the current of the primary coil U, and these induce in the secondary coil U′ of the induction-coil, which is included in the main line, a similar series of interruptions. These vibrations passing over the main line will divide at the home receiving-instrument, a portion going through the coil f' of the artificial line F and to ground, and the remainder going through the coils e' e^2 to line, and this will result, as is well kown, in rendering neutral the home receiving-instrument. The currents coming over the line from the distant station, however, will pass through the coils e^2 and e', which are wound in the same direction, and through the artificial line to ground, and these of course will affect the magnet of the receiving-instrument and produce vibrations in the sectors thereof in a manner heretofore stated.

The arrangement of the coil G producing the magnetic field is clearly illustrated in the diagram, and in Fig. 1 I have shown it connected to the binding-posts 12 13, while the main and artificial lines are connected to the binding-posts 14, 15, and 16, as indicated.

From the above the principles of construction and operation of my improved receiving device will be clearly understood, and it is evident that I am not limited to the precise details shown, as they may be varied without departing from the spirit of my invention; but I have found this arrangement and construction to constitute an exceedingly simple and effective apparatus, which is cheaply made and not liable to get out of order, and which is effective in the hands of ordinary operators.

What I claim is—

1. In a tone or harmonic telegraph, a magnet controlled by main-line currents, and a series of sectors adjustable to vibrate at different rates arranged in proximity to and operated by said magnets, substantially as described.

2. In a tone or harmonic telegraph, a magnet controlled by main-line currents, a series of sectors adjustable to vibrate at different rates arranged in proximity to and operated by said magnet, contact devices carried by the sectors, and adjustable contact devices arranged to make contact with the first contact devices, substantially as described.

3. In a tone or harmonic telegraph, a magnet operated by main-line currents, a series of sectors adjustable to vibrate at different rates operated thereby carrying contact-pieces, and a series of levers carrying other contact-pieces arranged to co-operate therewith, substantially as described.

4. In a tone or harmonic telegraph, a magnet controlled by main-line currents and a series of vibrators operated thereby, the vibrators being provided with adjustable weights to regulate their rates of vibration, substantially as described.

5. In a tone or harmonic telegraph, the combination, with a series of vibrators carrying contact-pieces, of a series of levers also carrying contact-pieces, a series of arms forming fulcra for said levers, and adjusting devices for regulating the contacts, substantially as described.

6. In a tone or harmonic telegraph, a magnet consisting of a central core surrounded by a main-line coil, and an exterior rim and a series of vibrators secured to said rim and extending in proximity to the core, substantially as described.

7. In a tone or harmonic telegraph, a magnet having a central core and an exterior rim, a series of vibrators carrying contact-pieces secured to the rim, arms also secured to the rim, and a series of levers supported upon said arms carrying contact-pieces, substantially as described.

8. In a tone or harmonic telegraph, the combination, with a series of vibrators carrying contact-pieces, of arms supported above the vibrators, levers carrying contact-pieces supported on said arms, and adjusting-slides secured to said arms, substantially as described.

9. In a tone or harmonic telegraph, the combination, with the vibrators carrying contact-pieces, of the levers also carrying contact-pieces on their short arms and having adjusting devices operating upon their long arms, substantially as described.

10. In a tone or harmonic telegraph, the combination, with a magnet operated by main-line currents, of a coil connected with the magnet operated by a local current creating a field of force, and a series of sectors arranged to be operated by said magnet, substantially as described.

11. In a tone or harmonic telegraph, a magnet having a differentially-wound main-line-circuit coil and a local coil, and a series of vibrating devices arranged to be operated by said magnet, substantially as described.

12. In a tone or harmonic telegraph, the combination, with a transmitter arranged to send a series of varying predetermined signals over the line, of a receiving-instrument or analyzer consisting of a magnet operated by the main-line currents, and a series of sectors operated by said magnet, substantially as described.

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

FRANÇOIS VAN RYSSELBERGHE.

Witnesses:

W. T. BARNARD,

E. I. BARNARD.