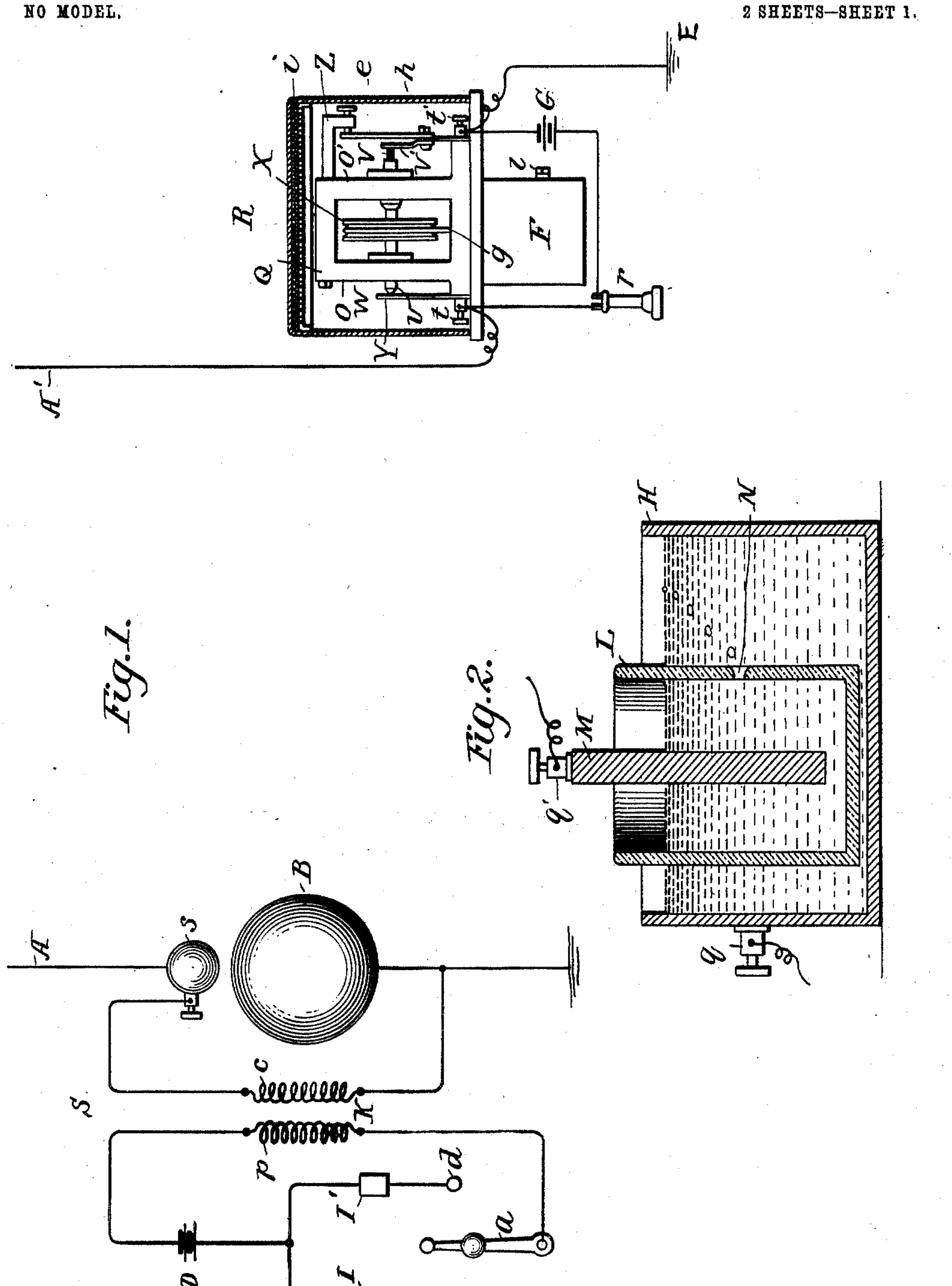
No. 759,826. PATENTED MAY 10, 1904.

J. MURGAS.

METHOD OF COMMUNICATING INTELLIGENCE BY WIRELESS TELEGRAPHY.

APPLICATION FILED FEB. 24, 1904.

NO MODEL. 2 SHEETS—SHEET 1.



Witnesses
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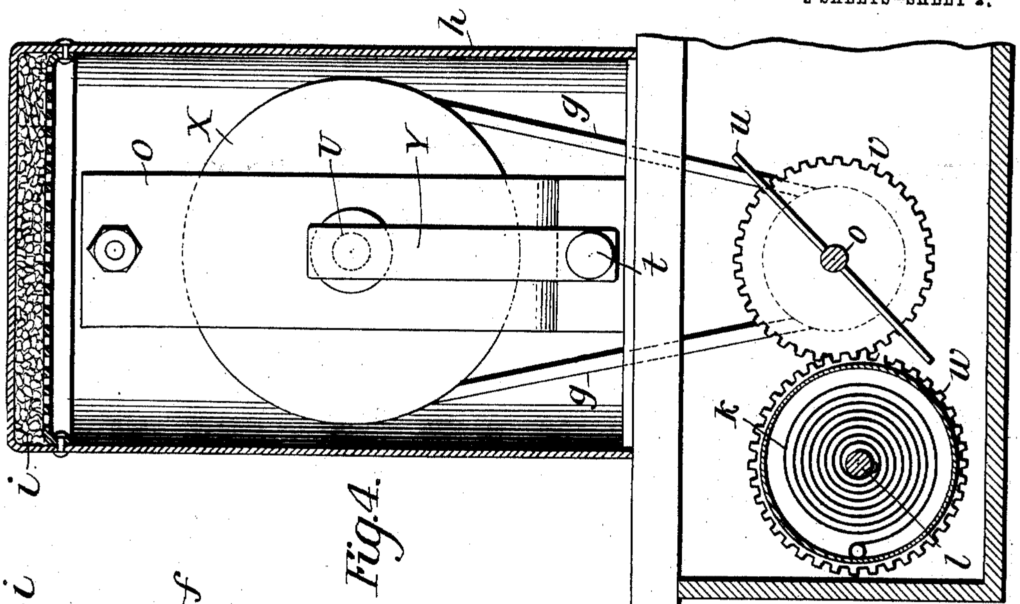

Fig. 4.

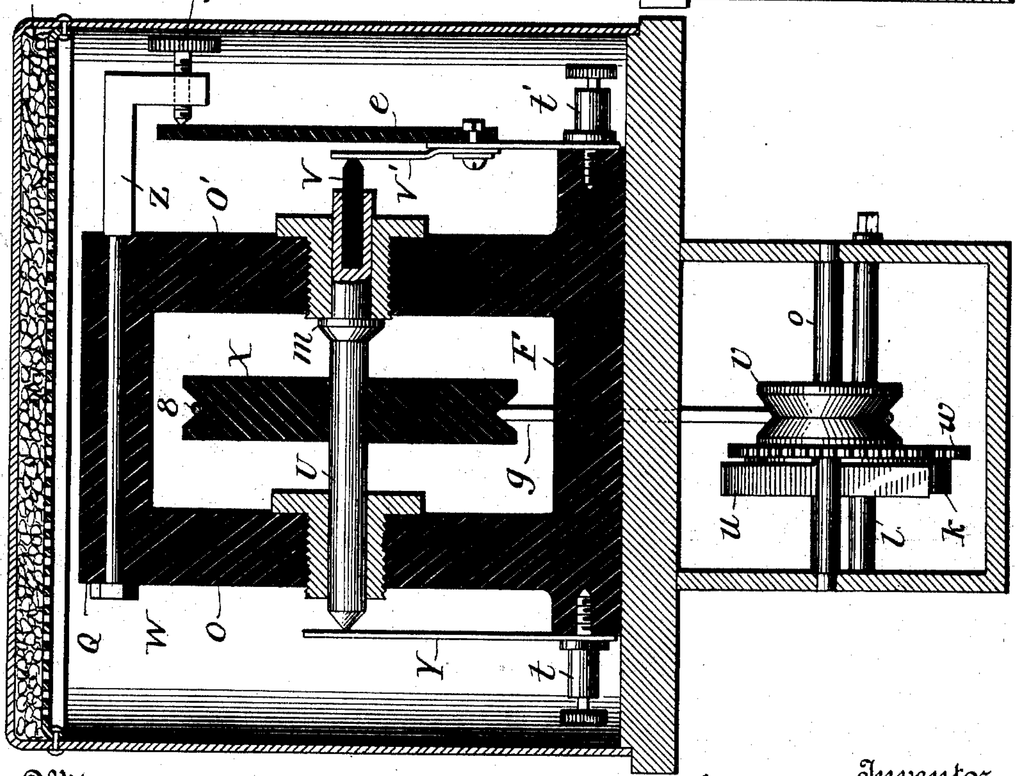

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOSEPH MURGAS, OF WILKESBARRE, PENNSYLVANIA.

METHOD OF COMMUNICATING INTELLIGENCE BY WIRELESS TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 759,826, dated May 10, 1904.

Original application filed October 2, 1903, Serial No. 175,499. Divided and this application filed February 24, 1904. Serial No. 195,091. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH MURGAS, a citizen of the United States, residing at Wilkesbarre, in the county of Luzerne, State of Pennsylvania, have invented certain new and useful Improvements in Methods of Communicating Intelligence by Wireless Telegraphy, of which the following is a specification.

My invention relates to wireless-telegraph systems, and has for its object the provision of an improved method whereby signals may be transmitted with great rapidity and accuracy.

This application is a division of my application, Serial No. 175,499, filed October 2, 1903.

It has heretofore been the practice in systems of the character described to transmit a message by means of successive impulses or signal elements of the same character, a given signal being detected by the time relation of the impulses in a manner similar to that observed in connection with the dot-and-dash system of Morse. It is obvious that if in a given system one signal requires a greater time for its despatch than others—for instance, the dash of the Morse system requires a longer time interval than the dot of that system—a message so transmitted would require a greater time than one in which the signals were independent of the time relation of the impulses, so that each impulse could be made as short as would be consistent with practical operation. I accomplish this result by providing sending apparatus which is capable of sending impulses of different character and receiving apparatus by which such impulses are received and their difference in character made manifest. According to my invention, therefore, the message depends upon the character of the impulses, as the frequency, intensity, &c., rather than their time relation, and letters, words, and messages may be conveyed by different arrangements of disconnected impulses or signal elements of unlike character in a manner similar to the combination of dots and dashes in the Morse system. Thus the impulses may differ in their frequencies, and by the word "frequencies" I intend to express the number of variations which occur in the circuit of the sending apparatus during a given time when that circuit is closed—as, for instance, where an interrupter is in the circuit I intend to indicate the number of interruptions of the circuit in a given time, and therefore the frequency of discharge across the spark-gap—*i. e.*, spark-gap frequency or wave-train frequency, both of which terms have well-understood meaning in the art. By the word "impulse" I intend to express the flow of energy due to a single manipulation of the signal-controlling means—as, for example, a circuit-closing key. In a sending-circuit containing a key and interrupter the interrupter may be of high frequency, opening and closing the circuit many times during a single closure of the key even when the key is operated with maximum rapidity, and the frequency of the impulse due to the key-closure corresponds to that of the interrupter. Such impulses being received in an ordinary telephone-receiver by means of proper apparatus, tones differing in pitch will be produced, and while the number of tones which may be produced is indefinite and a variety of codes may be used two tones are sufficient to produce a system analogous to the Morse, one tone corresponding to the dot and the other to the dash. For reasons as already stated the rapidity of transmission will be greatly increased by such a system, and, moreover, signals differing in character are more readily distinguished from each other than those which depend upon time intervals for differentiation. Tones are well distinguished in physics from other sounds, and the range of frequencies of vibration within which tones are produced is sharply defined. They are more readily distinguished than other sounds, and hence in systems employing a telephone-receiver I prefer to make the frequencies of the impulses come within the range to produce a tone. A telephone-receiver of the ordinary type may be used as the means for indicating the reception of the impulses, and where all the impulses are received by the same apparatus it is necessary to employ a self-restoring coherer—that is, one in which the parts assume their normal condition after an impulse has ceased and do not maintain the contact established by the impulse after the impulse has passed. Failure to do this would result in confusion of the signals, and various means—such as tapping the parts, providing vibrating contacts, and contacts having a rubbing or rolling engagement—have been proposed. I provide a wave detector or coherer which is remarkably free from noise when in operation. This is an important consideration where the signals are received by a telephone-receiver, and particularly where it is essential that the pitch of the sounds be distinguished.

My invention can best be described in connection with the accompanying drawings, which illustrate an application of said invention; but it may have other embodiments and applications without departing from the spirit and scope of my invention.

Referring to the accompanying drawings, Figure 1 is a diagram showing transmitting and receiving stations according to my invention. Fig. 2 shows the form of interrupter which I have found it best to employ, and Figs. 3 and 4 show my improved "imperfect contact."

Referring to the figures, the sending-station S is equipped with the usual aerial wire A, terminating in the sphere *s*. Separated from the sphere *s* by a spark-gap is a larger sphere of conducting material B, which may or may not be conducted to earth, although the operation is improved if so connected, both of said spheres being equipped with terminals to which are connected the extremities of secondary *c* of the induction-coil K. The primary *p* of the induction-coil is connected at one end to the switch-arm *a* and at the other end to one terminal of the battery D. Circuit may be completed through the primary *p* and battery D in series by moving the switch-arm *a* into contact with either of the terminals *b* or *d*. The terminal *b* is connected to one terminal of an interrupter I, while the terminal *d* is connected to a similar interrupter I′. The other terminals of the interrupters I and I′ are joined together and connected to one terminal of the battery, as shown. If, therefore, switch-arm *a* is in contact with terminal *d*, circuit for the battery and primary of the induction-coil will be completed through the interrupter I′, and, similarly, if the switch-arm is in contact with the terminal *b* circuit will be completed through the interrupter I.

At the receiving-station R is a vertical wire A′, similar to that at the sending-station S. The wire A′ is connected at its lower end to a terminal *t*, mounted upon the base F of the imperfect contact or wave-detecting device W. Thence connection is made through the wave-detecting device W to terminal *t′*, and thence to ground at E. Connected across the terminals *t* and *t′*, and therefore in multiple with the wave-detecting device W, is a telephone-receiver *r* and a battery G. When an impulse arrives at the receiving-station, it is transmitted from the wire A′ through the wave-detecting device W to the ground at E. The passage of this impulse through the wave-detecting device operates to change the resistance of the contacts of the device, and therefore changes the resistance of the circuit through telephone-receiver *r* and battery G. The result of thus changing the resistance is to change the current flowing in the circuit of the telephone-receiver, thereby causing movement of the diaphragm, and the diaphragm will during an impulse vibrate with a frequency corresponding to that of the impulse—that is, to the frequency of the interrupter which is for the time being connected in the sending-circuit. If the interruptions are of sufficient rapidity, a musical tone will be produced, and different frequencies of interruption will produce tones of different pitch. The interrupters I and I′ are designed so that when one of them is connected in circuit one rate of interruption will be caused, while a different rate of interruption will occur when the other interrupter is in circuit. If, therefore, the switch-arm *a* of the sending-station S be made to contact at one time with terminal *d* and at another time with terminal *b*, different tones will be observed in the telephone-receiver *r* at the receiving-station R, and if it be understood that one tone corresponds to a dash and the other tone to a dot of the Morse system a code of signals can be arranged which in rapidity and accuracy of transmission greatly excel any of the systems in which a dot-and-dash arrangement is employed.

I have outlined the operation of my system and the apparatus employed in a general way and will now describe details of construction of the apparatus which it was not practicable to show in the diagram.

In Fig. 2 is shown an interrupter of the Wehnelt type, which I have found to give best results in practice. The drawings show this interrupter in section. The inclosing casing H is of lead and at one side has secured to it the terminal *q*, to which one of the circuit-wires is to be connected. Within the casing H is a second casing L, of insulating material, within which is suspended a leaden electrode M, carrying the terminal *q′*, to which the other circuit-terminal is connected. In one side of the casing L is an aperture N, by means of which communication between the interior and exterior of the casing is secured. Both casings are then filled with dilute sulfuric acid, as shown. Upon the passage of current through the interrupter gases are generated, which escape through the aperture N and in so doing break the circuit between the circuit-terminals, and it has been found that the frequency of the interruptions for a given size of aperture N is practically fixed and that this frequency can be regulated by varying the size of said aperture.

In Figs. 3 and 4 I have shown details of the wave-detecting device W. Said device consists of a base F, to which are secured the upright pieces O and O′, which are joined together at the top by a piece Q, which may or may not be integral with pieces O and O′. Suitably journaled in upright pieces O and O′ is a shaft U, carrying at one end a carbon pencil V, which is tapered at one end to form a truncated cone and the opposite end of said shaft being sharpened to a point. Rigidly secured to the shaft between the uprights O and O′ is a grooved wheel X. Bearing against the pointed end of the shaft U and in electrical connection with the terminal *t* is a spring Y, pressing axially of the shaft and adapted to maintain electrical contact with the shaft U and force the shoulder *m* upon the shaft against its bearing in the upright O′. In electrical contact with the terminal *t′* and adapted to bear against the carbon pencil V at its tapered end is a spring, to which is secured the adjusting-bar *e*, which is in engagement with the adjusting-screw *f*, which is supported by the arm Z, which is in turn supported by the uprights O and O′. By means of the adjusting-bar *e* and adjusting-screw *f* the pressure between the spring Y′ and the carbon pencil V may be adjusted. Within the groove upon the wheel X is a cord or band *g*, by means of which the shaft U and carbon pencil V may be turned. When in operation, the shaft is moved with sufficient speed if it make one revolution in one or two hours, and I have found that where the contacts are given a relative movement, as described, superior results are obtained, which I believe is due to the decoherence, avoidance of scratching action, and the cleaning and polishing of the contacting portions. I have further discovered that if precautions are not taken to maintain the contacts of the wave-detector in a dry condition their efficiency is greatly impaired and the operation of the apparatus may even be interrupted. In order to prevent occurrences of this kind, I place these contacts within a compartment, as is formed, for instance, by placing the cover *h* over them, and including within the compartment a moisture-absorber *i*, which may be calcium chlorid or other suitable material, and which is shown in this case as being placed in a chamber located at the top of cover *h*. The wheel X may be driven by any suitable mechanism, as clockwork; but I have found that clockwork in which the ordinary escapement regulation is employed produces a decided tick in the telephone-receiver at the receiving-station. I therefore provide an air-vane for regulating the speed of the apparatus. This is shown in Fig. 4, in which an actuating-spring *k* is secured to a stationary part at one end and at the other end to a shaft *l*, said shaft being connected to shaft *o* by means of the gearing *w*, the shaft *o* having rigidly secured to it the vane *u* and also the grooved pulley-wheel *v*, the pulley-wheels *v* and X being connected by the band or belt *g*. It will be seen that as the spring operates to rotate the shafts O and U the vane *u* is rotated and operates to regulate the speed of movement of the shaft U. It will of course be understood that proper gearing for securing the desired ratio of movement of the parts will be supplied.

Without limiting myself to precise details, what I claim is—

1. The method of communicating intelligence by wireless telegraphy which consists in transmitting and receiving disconnected signal elements, each differing in spark frequency from the others.

2. The method of communicating intelligence by wireless telegraphy which consists in transmitting and receiving disconnected signal elements, each differing in spark frequency from the others, the spark frequencies lying within the range to produce tones.

3. The method of communicating intelligence by wireless telegraphy which consists in transmitting at will disconnected signal elements, each differing in spark frequency from the others, and receiving said signal elements.

4. The method of communicating intelligence by wireless telegraphy which consists in transmitting disconnected signal elements, each differing in spark frequency from the others, according to a predetermined code, and receiving said signal elements.

5. The method of communicating intelligence by wireless telegraphy which consists in transmitting disconnected signal elements, each differing in spark frequency from the others, according to a predetermined code, and receiving said signal elements in a common indicating device.

6. The method of communicating intelligence by wireless telegraphy which consists in transmitting at will disconnected signal elements, each differing in spark frequency from the others, said spark frequencies lying within the range to produce tones, and receiving said signal elements in a telephone-receiver.

7. The method of communicating intelligence by wireless telegraphy which consists in transmitting at will disconnected signal elements, each differing in spark frequency from the others, and receiving said signal elements in a common indicating device.

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

JOSEPH MURGAS.

Witnesses:

M. H. McAniff,

Tillie Dougherty.