No. 717,773. PATENTED JAN. 6, 1903.

H. SHOEMAKER.

SIGNALING SYSTEM.

APPLICATION FILED AUG. 19, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig 1.

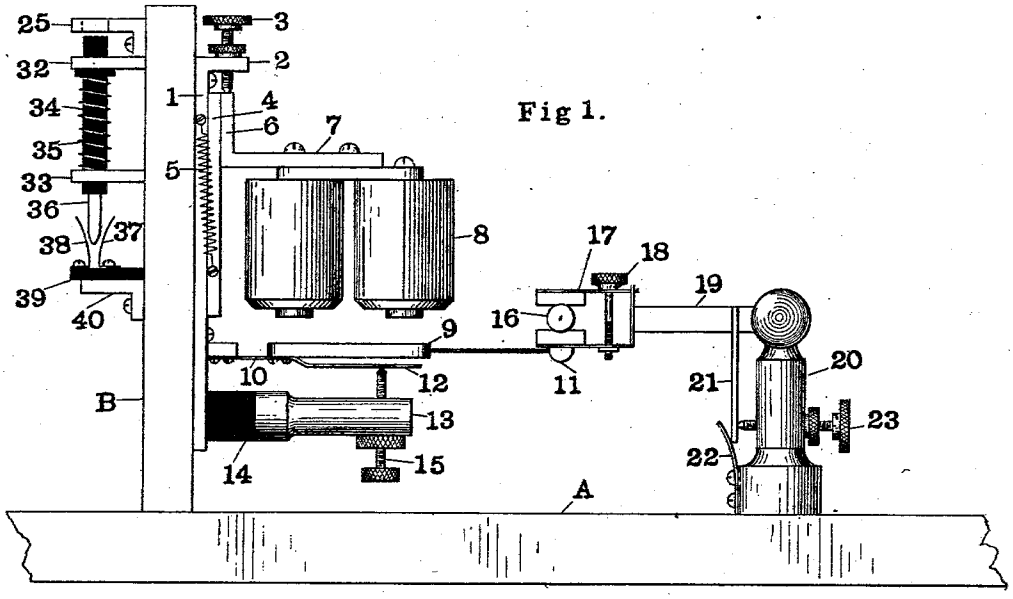


Fig 2.

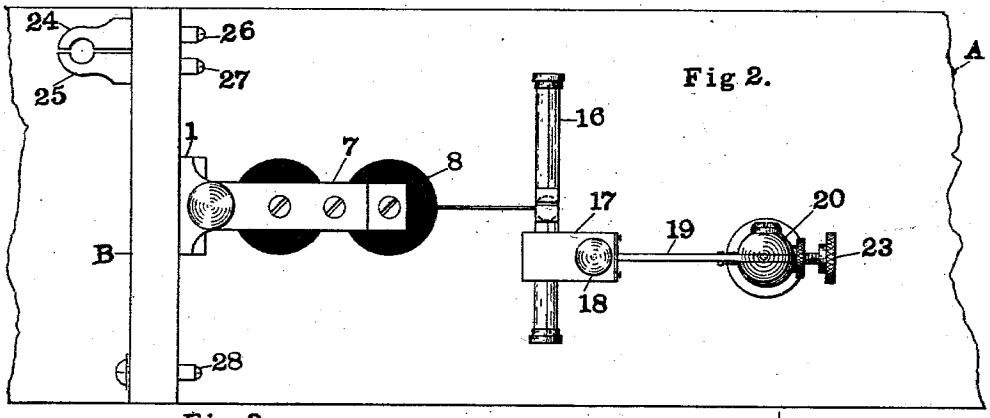


Fig 3.

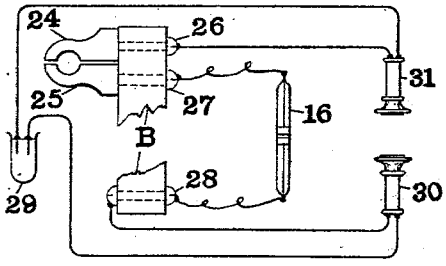
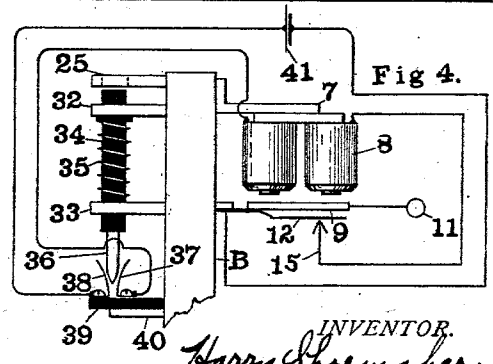


Fig 4.



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APPLICATION FILED AUG. 19, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig 5.

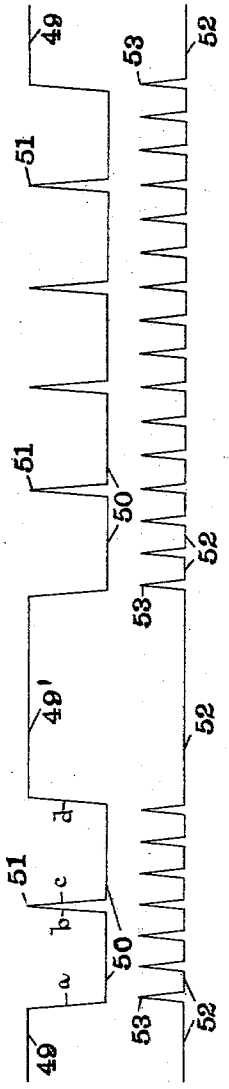


Fig 7.

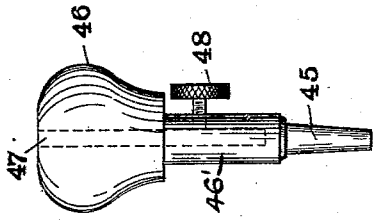
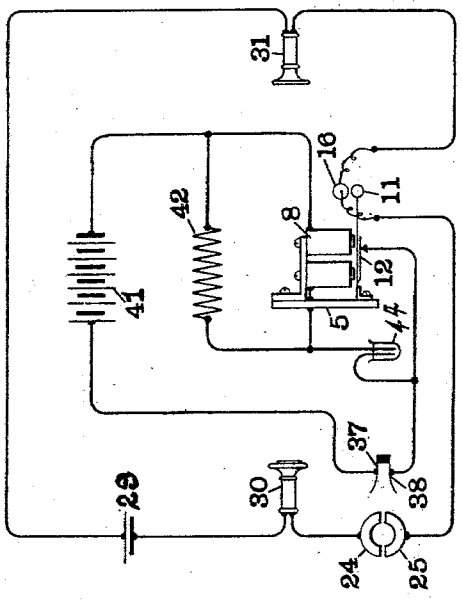


Fig 6.



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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 717,773, dated January 6, 1903.

Application filed August 19, 1902. Serial No. 120,174. (No model.)

To all whom it may concern:

Be it known that I, HARRY SHOEMAKER, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Signaling System, of which the following is a specification.

My invention relates to electrical signaling, more especially those systems in which electroradiant energy is employed in transmission to the receiving-station.

My invention relates to wireless signaling in which electromagnetic waves are impressed upon the natural media and at the receiving-stations produce manifestations, thereby reproducing signals.

My invention comprises, further, a system of signaling in which there is employed at the receiving-station a wave-responsive device having the property of greatly changing its resistance under the influence of the received electroradiant energy and which is required to be mechanically shocked in order to be restored to its normal condition. This wave-responsive device, of which the more common type is the ordinary coherer, is continuously tapped or shocked at a relatively high rate, and in the local circuit controlled by the wave-responsive device is connected a source of energy and telephone-receiver. The trains of waves emitted at the transmitting-station follow one another so closely according to this system that the trains of waves are many times greater in number in a definite interval of time than the number of taps or shocks administered to the coherer. In other words, the trains of waves arriving in a certain interval of time are very great with respect to the number of taps administered to the coherer, so that there is produced in the telephone-receiver a quick succession of clicks, such train of clicks being, in fact, the effect of the numerous taps applied to the coherer. For a certain code character—a dash, for example—there are emitted at the transmitting-station numerous trains of waves which closely follow each other. Presuming the coherer to be in its normal condition, the arrival of the first train of waves breaks down its resistance, and the succeeding trains of waves produce no effect whatsoever. After several trains of waves have arrived, however, the independent tapping means restores the coherer to its original resistance, thereby causing a click in the telephone; but, inasmuch as the trains of waves continue to arrive, the resistance is again reduced, and the succeeding trains have no effect until a second tapping of the coherer, and so on. The trains of waves representing a dash have a tendency to keep the coherer during such period at low resistance, and it is at definite intervals only that its resistance is restored by means of the continuous tapper, which is independent of the coherer and not controlled, as is usual, by a relay.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is a side elevation of the apparatus. Fig. 2 is a plan view of the same with portions omitted. Fig. 3 is a diagrammatic view of the circuit of the wave-responsive device. Fig. 4 is a diagrammatic view of the circuit of the tapping device. Fig. 5 is a graphical representation of the behavior of the continuously-tapped wave-responsive device during the reception of electroradiant energy. Fig. 6 is a diagrammatic representation of the circuit at a receiving-station. Fig. 7 is a view in elevation of the plug adapted to be inserted between the contacts 24 and 25 and to cause contacts 37 and 38 to be bridged by 36.

A is a base of wood or other insulating material, upon which is erected a standard B of like material.

1 represents a metallic plate secured to the member B, which has a horizontally-extending bracket 2, through which passes the thumb-screw 3, pressing against the plate 4 or anything secured thereto in opposition to a spring 5, which normally tends to lift the plate 4 and whatever is carried thereby.

6 is an arm or bracket secured to said plate 4 and whose horizontal member 7 supports the electromagnets 8 of the tapping device.

9 is the usual soft armature, which is supported by a spring 10 and which carries at its

outer end the hammer 11, which engages the coherer.

12 is a spring contact device of the usual trembler arrangement of tapper, in engagement with which is the thumb-screw 15, passing through the post 13, supported on the insulating material 14.

At 16 is shown the usual type of coherer, which is supported between the lined jaws 17, which are closed upon the coherer 16 by means of the thumb-screw 18. These jaws 17 are at the ends of the arm 19 pivoted in the top of the standard 20. Extending vertically downward from the member 19 is the rod 21, which is normally urged at its lower end toward the rod by means of the leaf-spring 22.

23 is a thumb-screw extending through standard 20 and engaging against the arm 21. By means of this screw 23 the position of the coherer may be determined, so as to obtain an adjustment with respect to the hammer 11.

24 and 25 are the two halves of a metallic plug-seat secured on the rear of the member B and in electrical communication with which are the screws or binding-posts 26 and 27, respectively.

32 is a horizontal bracket extending from the member B, as is also 33, and through alined holes in such bracket extends the member 34, of insulating material, and having just below the bracket 32 an extension or collar, between which and the member 33 is located the spiral spring 35, which resists the downward motion of the member 34. At the lower end of this member 34 is carried a contact-piece 36, which when the member 34 is depressed bridges the contacts 37 and 38, closing the circuit through them. The springs 37 and 38 are supported upon a sheet of insulating material 39, held in position on member B by the bracket 40. A plug having a metal portion is inserted between members 24 and 25 and is of such dimensions that when it has come to make contact between members 24 and 25 it has forced member 34 downward in order to close the circuit through the springs 37 and 38. In Fig. 7 is shown a detail of this plug, whose handle portion is represented at 46. Extending downwardly from this handle portion is the metallic shank 46′, having the conical end 45. Through the portion 46 and into the portion 46′ extends an opening 47, into which is extended the lower end of the aerial conductor, which is held in metallic engagement with 46′ by means of the binding-screw 48. The tapering portion 45 bridges the contacts 24 and 25 and its lower end engages the top of the member 34, forcing it downwardly until the contacts 24 and 25 are bridged by 45, at which time the metallic member 36 contacts with both 37 and 38.

In Fig. 3 it is seen that were the members 24 and 25 bridged metallically the wave-responsive device 16 would be in series with the binding-posts 27 and 28, telephone-receivers 30 31, and the source of energy 29. When applied to a receiving-station, the plug which is inserted between the members 24 and 25 is in electrical communication with the aerial conductor and the binding-post 28 communicates with an earth-plate.

In Fig. 4 it is seen that when the plug is inserted between members 34 and 25, or, in other words, when springs 37 and 38 close the circuit through member 36, the magnets 8 are in series with the source of energy 41 and the trembler-interrupter 12 and 15.

In Fig. 6 are shown the circuits of both the wave-responsive device and also of the tapping device. From this figure it is apparent that the circuits of the tapping device are entirely independent of the circuit of the wave-responsive device or of any device controlled by the wave-responsive device. 42 represents a non-inductive resistance in shunt to the tapper-magnets 8, and 44 represents an electrolytic cell in shunt to the break of the tapper-trembler. Both these devices are for the purpose of eliminating the effects of the winding 8, which might otherwise cause a false signal to be recorded.

In Fig. 5 is a graphical representation of the changes of resistance of the wave-responsive device during the reception of electroradiant energy. The numerous peaks 53 represent trains of waves of electroradiant energy, the magnitude of whose effect or energy is represented by the height of these peaks above the base-line 52. The base-line 50 represents the low resistance of the coherer or wave-responsive device, the normal resistance being represented by the line 49. Normally the resistance of the device is high, and the magnitude of this resistance is represented by the distance between lines 49 and 50. Time is represented by distance along lines 49, 50, and 52 from left toward the right. Initially the resistance of the coherer is high and no electroradiant energy is being transmitted. At the first train of waves (represented by the first peak 53 to the left) the resistance of the coherer drops suddenly to the point represented by line 50, such drop being represented by the steep line *a*. The resistance of the coherer remains low even though the second and third wave-trains are arriving. After the arrival of several wave-trains, however, the coherer is tapped and its resistance rises instantly again to normal, but is immediately reduced again, because of the close succession of the next wave-train. This increase of resistance to normal due to the tapping is represented by line *b*, while *c* represents its immediate drop in resistance because of the persistence of wave-trains. At about the time of arrival of the seventh wave-train of the first series represented the coherer is again tapped and its resistance increases to normal, as represented by the line *d*. Because, however, of the non-arrival of further wave-trains the resistance of the coherer remains at normal for a considerable time, as

represented by the line 49'. A second series of wave-trains is represented several times longer than the first series. The first series may represent a dot, while the second series may represent a dash of a telegraphic code. These changes of resistance of the coherer during the arrival of electroradiant energy cause clicks in the telephone-receivers 30 and 30. For the dot represented by the first series of trains of waves there would be three clicks and for the dash represented by the long series of wave-trains there would be six clicks in the telephone-receivers. If the rate of the tapper is sufficiently high, these clicks will produce an effect in the nature of a note in the receivers 30 and 31.

The method of operation is as follows: Upon inserting the plug between members 24 and 25 to bridge them the circuit is closed between springs 37 and 38 and the trembler immediately begins to operate and does operate continuously, causing the hammer 11 to continuously tap the wave-responsive device 16. Upon the reception of the train of waves the first train will cause a drop in resistance of the device 16, thereby causing a click in the receivers 30 and 31, and the succeeding trains of waves will have no further effect until the hammer 11 strikes device 16 to decohere it. This change in resistance causes a second click in the telephone; but inasmuch as the trains of waves are persistent the resistance of the tube is again quickly reduced. Inasmuch as the rate of this tapper is considerable, upon the reception of a code character, which is represented by the succeeding trains of electromagnetic waves, device 16 will be decohered several times to produce a uniform succession of restorations, thereby producing uniform clicks in receivers 30 and 31. If, for example, five or six of these clicks come close and uniformly together, it may represent a dot, whereas if fifteen or twenty come close together and in rapid succession the character may represent the dash of the usual telegraphic code.

To make this system successful, it is necessary that at the transmitting-station the trains of waves representing a code character be numerous and follow each other at very rapid rate. For this purpose an alternating current of relatively high frequency may be used in the primary of an ordinary sending-transformer, so that at the usual spark-gap the sparks will be in very rapid succession, thereby producing trains of waves in very rapid succession.

It is preferable to have the rates of the tapper and of the trains of waves differ as greatly as possible, so that there will not occur what in acoustics is known as "beats." For example, were the rates of the tapper and the trains of waves the same and both of them relatively low in rate there would occur frequently a tap upon the wave-responsive device just at an undersired moment, thereby producing a confusion of signals. By my system, however, the rates of the tapper and of the trains of waves differ greatly and this possible defect is avoided.

I am aware that a coherer has been restored to its normal condition by a device continuously operating in its vicinity to jar or shock the support of the coherer. This, however, is not my system, as heretofore explained.

What I claim is—

The method of transmitting intelligence, which consists in generating and impressing upon a medium trains of electroradiant-energy waves at a selected rate and representing elements of a signal, subjecting a wave-responsive device to the influence of said wave-trains, and restoring said wave-responsive device at a rate which is low in comparison with the rate of succession of the transmitted wave-trains, the rate of restorations being determined with regard to the duration of the shortest element of a signal.

HARRY SHOEMAKER.

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ALICE T. BURROUGH.