No. 717,770. PATENTED JAN. 6, 1903.

H. SHOEMAKER.

WIRELESS SIGNALING SYSTEM.

APPLICATION FILED JUNE 16, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

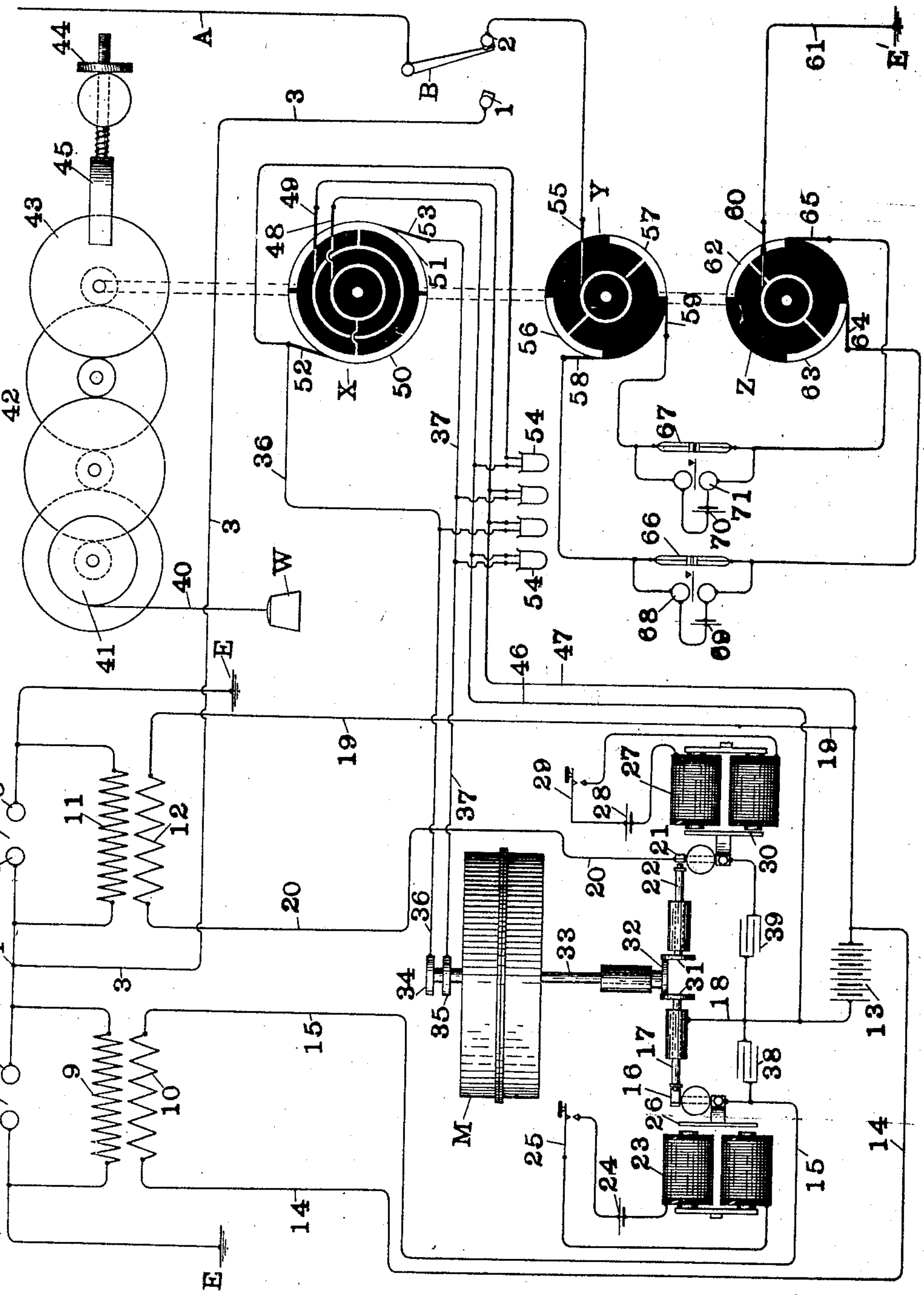

Fig 1.

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[illegible]

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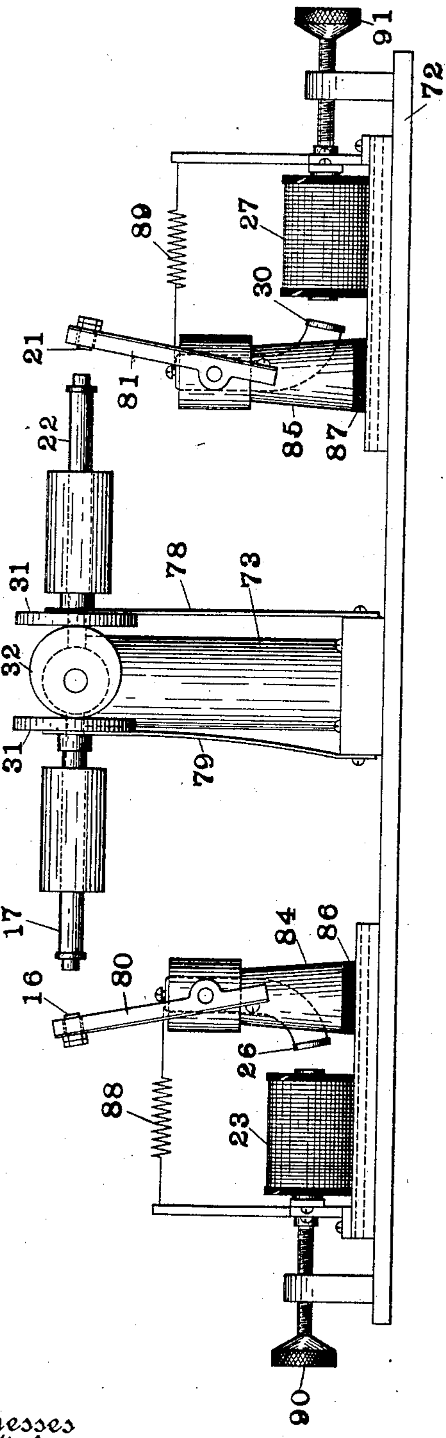

Fig 2.

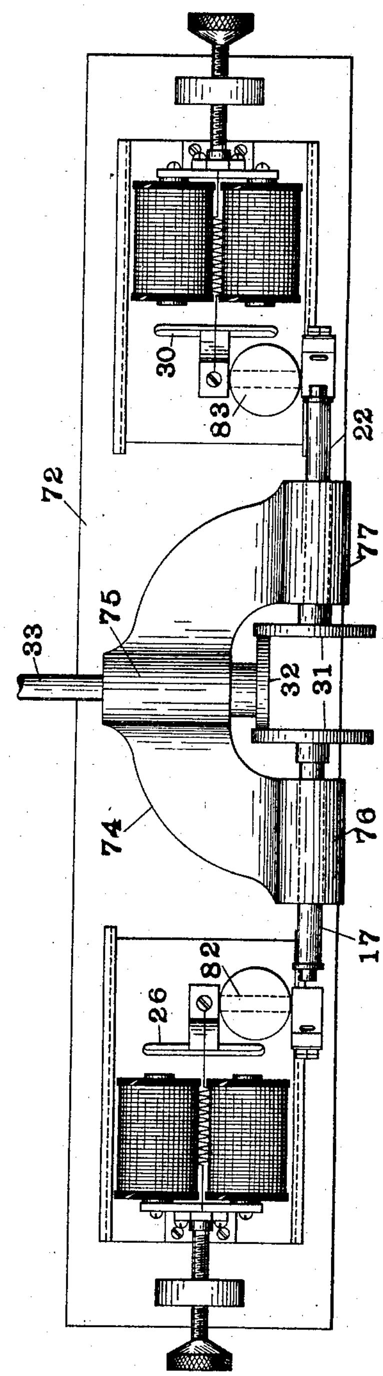

Fig 3.

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UNITED STATES PATENT OFFICE.

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WIRELESS SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 717,770, dated January 6, 1903.

Application filed June 16, 1902. Serial No. 111,819. (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 Wireless Signaling System, of which the following is a specification.

My invention relates to electrical signaling, more particularly those systems in which electroradiant energy is employed and controlled to represent messages to be transmitted. Such systems require no metallic or artificial conductors to extend between the transmiting and receiving stations, energy representing messages to be sent being transmitted through the natural media.

My system comprises a system of wireless signaling whereby messages may be simultaneously sent or received without interference with each other. It comprises means for alternately impressing upon the natural media from a common or single radiating-conductor amounts of energy representing the signals to be sent and also means for receiving from a single receiving-conductor the energies representing a plurality of signals and selecting such energies to the proper receiving devices. By this means a single aerial conductor or other radiating-circuit is required, and in some cases the installing of such aerial conductor is a matter of great expense, and therefore using the same for a plurality of messages instead of a single message at a time results in an economy.

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

Figure 1 is a diagrammatic view of the circuits at a station, showing both the transmitter and receiver. Fig. 2 is an elevational view of a portion of the controlling apparatus of the transmitter. Fig. 3 is a plan view of the same.

A is the aerial conductor of a wireless signaling system, which is used both for the transmission and reception of signals. At its lower end it connects with the switch-arm B, whose lower end is adapted to engage with either of the contacts 1 or 2. When switch-arm B is in engagement with 1, the station is being operated as a transmitting-station, in which case conductor 3 connects at 4 with the knobs 5 and 6. The knobs or spheres 7 and 8 form with said knobs 5 and 6, respectively, spark-gaps S S′, and said knobs 7 and 8 connect to earth-plates E E.

9 is the secondary of a transformer or induction-coil whose terminals connect to the knobs 5 and 7, respectively. 10 is the primary of the same induction-coil or transformer.

11 is the secondary of the induction-coil or transformer, whose terminals connect, respectively, to the knobs 6 and 8, and for which 12 operates as the primary winding.

13 is a source of energy from one terminal of which leads a conductor 14 to one terminal of primary 10 and from whose remaining terminal the conductor 15 leads to the contact 16 of an interrupter whose second contact is on the reciprocating bar 17. From said reciprocating bar 17 the conductor 18 leads to the remaining terminal of the source of energy 13, and conductor 19 leads from one terminal of the source of energy 13 to the right-hand terminal of primary 12, whose remaining terminal connects by conductor 20 to the contact 21 of an interrupter whose second contact is mounted upon the reciprocating bar 22, which reciprocating bar 22 is in metallic connection with reciprocating bar 17 and contacts by the conductor 18 to the remaining terminal of the source of energy 13.

The electromagnets 23 are in a circuit with the source of energy 24 and an operator's key 25. When said key 25 is depressed, the magnets 23 are energized and attract armature 26, thereby tilting contact 16, so that it shall come into the path of the reciprocating contact 17, and thereby cause an interrupted current to flow through the primary 10, causing the usual sparking at S, with the consequent charging of the aerial conductor A, which charge then oscillates across the gap S, and in so doing radiates energy of high frequency.

27 represents electromagnets in circuit with source of energy 28 and an operator's key 29. When said key 29 is depressed, the magnets 27 are energized, causing then an attraction

of the armature 30, which then tilts the contact 21 into the path of the reciprocating contact 22, resulting in an interrupted current flowing through the primary 12, causing in turn a sparking at S′ and radiation of energy through the aerial conductor A, as previously described.

Contacts 17 and 22 are provided at their inner ends with disks 31, which are operated by eccentric 32, mounted upon the shaft 33 and driven by synchronous motor M. The disks 31 are urged toward each other by leaf-springs, hereinafter to be described.

34 and 35 are slip-rings upon which bear brushes in connection with the conductors 36 and 37.

The field-winding of the synchronous motor M is of the usual type—namely, separately excited by continuous current. The rotation of the shaft 33 as driven by the armature of the motor M causes the eccentric 32 to move the reciprocating contacts 17 and 22 in opposition to the leaf-springs, which urge them toward each other. While contact 17 is in position to cause current to flow through the primary 10 the contact 22 has been moved to the left, due to the leaf-springs, so that no contact can be made with 21 and no current can then flow through primary 12. In other words, the contact is made intermittently and alternately by 17 and 22, resulting, therefore, in alternate trains of sparks at S and S′. This amounts to saying that key 25 alternates with key 29 in controlling alternate trains of sparks at spark-gaps S and S′ and in consequence alternate trains of electrical radiations from the aerial conductor A.

38 and 39 are condensers shunted across the breaks 16 17 and 21 22, respectively.

W is a weight which through cord 40 exerts a force on the drum 41 and through an intermediate train of gearing 42 drives the copper disk 43 and also the shaft upon which it is mounted. Said shaft carries in addition commutators X Y Z. The weight W then causes the rotation of said copper disk 43 and the three commutators at a very uniform rate, and such rate can be adjusted with a nicety by means of the screw 44, which moves backward or forward the horseshoe-magnets 45, between the limbs of which is rotating the copper wheel 43. By change in the position of permanent magnets 45 more or less energy is wasted by electrodynamic action in disk 43, therefore retarding more or less the speed of the shaft carrying the three commutators X Y Z.

From source of energy 13, which is generally a storage battery, lead the two conductors 46 and 47 to the brushes 48 and 49, respectively. The brushes 48 and 49 bear upon two slip-rings, as clearly shown in Fig. 1, and connections extend from such slip-rings to segments 50 51. These segments occupy approximately half of the surface of the commutator X. At opposite ends of the diameter and bearing upon said segments 50 51 are the brushes 52 53. From these brushes 52 53 extend the conductors 36 47, furnishing current to the armature of the synchronous motor M. The effect of commutator X, it is readily seen, is to commutate the current delivered from source of energy 13 into alternating impulses of current of a frequency dependent upon the speed of rotation of said commutator X. One complete revolution of said commutator transmits, therefore, to the armature of the motor M one positive impulse and one negative impulse, (so styled.) The speed of the shaft 33 will therefore, since M is a synchronous motor, be accurately regulated by the magnets 45 and the copper disk 43, as driven by the weight W. In other words, the rotation of the commutators X Y Z bears a perfectly definite relation to the speed of rotation of the armature M, and therefore of the interrupters whose contacts are 16 17 and 21 22, respectively.

Across every break at commutator X is connected electrolytic cells, four of which are shown at 54. The purpose of these is to eliminate the sparking as much as possible to prevent any undesired effects upon the wave-responsive devices near at hand.

Commutator Y comprises a slip-ring upon which bears a brush 55 in connection with contact 2. Such slip-ring is in electrical connection with segments 56 57, upon which bear the brushes 58 59. Commutator Z comprises a slip-ring which bears the brush 60, which is in connection through conductor 61 with earth-plate E′. The slip-ring is in electrical communication with the segments 62 63, upon which bear the brushes 64 65. These segments 56 57 of commutator Y occupy, as shown, approximately one-quarter of the circumference of said commutator, and segments 62 63 occupy approximately one-half the circumference of the commutator Z. The brushes 58 59 bear upon the commutator Y at points very closely ninety degrees apart, and the same is true of brushes 64 65 in relation to commutator Z. Supposing X Y Z to be rotating in a counter-clockwise direction, it is seen that brush 58 is just coming into contact with segment 56, and in the position of the switch B, as shown, brush 64 is just coming into communication with segment 63 on commutator Z. In other words, brush 64 is just coming into communication with the earth-plate E′. At the same instant brushes 59 and 65 have just made contact with segments 57 and 62, respectively. For one-quarter of a revolution of the commutators brushes 58 and 64 are therefore in engagement with segments 56 and 63, respectively, and in consequence for such periods of time wave-responsive device 66, such as coherer or anti-coherer, is in circuit between the aerial conductor A and the earth-plate E′, and during the same period of time wave-responsive device 67 is entirely isolated, because the brushes 59 and 65 are both bearing on the insulating material forming the body of the commutators Y Z. In shunt to the wave-responsive device 66 is the relay 68 and source of energy 69, the latter being connected between the coils of said relay, such coils acting then as the usual choke-coils. The tongue of said relay 68 controls the usual local circuits well known in wireless signaling. In shunt to the wave-responsive device 67 are similar arrangements, source of energy 70, and relay 71, whose tongue controls the circuit, including a second recording device. Upon the rotation of commutators Y Z through a further arc of ninety degrees wave-responsive device 66 is entirely cut out of circuit, while wave-responsive device 67 is cut into circuit. It is thus seen that the wave-responsive devices and their associated recording apparatus are alternately and for equal periods of time in communication with the aerial conductor A.

Referring now to Figs. 2 and 3, 72 is a metallic base upon which is mounted the standard 73, carrying at its top the semicircular-formed member 74, having the transversely-extending bearing 75 and the longitudinal extending bearings 76 and 77. In said bearing 75 is inclosed the shaft 33, carrying the eccentric 32, and in said bearings 76 and 77 reciprocate the rods 17 and 22, respectively. The leaf-springs heretofore mentioned are shown at 78 and 79, the latter shown in Fig. 2 as having pressed the reciprocating rod 17 to the extreme right, while spring 78 is shown as having been opposed to the rod 22, due to the action of eccentric 32. Contacts 16 and 21 are mounted on the leaf-springs carried by rocking members 80 and 81, respectively, which in turn are operated by armatures 26 and 30, respectively, under the influence of magnets 23 and 27, as heretofore described. Said members 80 and 81 are mounted on rock-shafts 82 and 83, respectively, having horizontal bearings on vertical standards 84 and 85, respectively. Insulated material 86 87 form the remaining metallic parts of the device. Conductor 18 is connected to the base 72 or the standard 73 at will, while conductors 15 and 20 are connected to standards 84 and 85, respectively. 88 89 are adjustable spiral springs which retract members 80 and 81, in so doing moving contacts 16 and 21, due to the reciprocating members 17 and 22, respectively. At 90 91 are shown adjustable screws for moving magnets 23 and standard 84 and magnets 27 and 85, respectively, in a longitudinal direction along the base of 72 for the purpose of determining the duration of contact between 16 17 and 21 22 and for other purposes.

The apparatus shown in Figs. 2 and 3 is practically a duplicate of the apparatus shown and described in my Patent No. 710,373, granted to me September 30, 1902.

The apparatus and circuits heretofore described are present at each of the stations of the system, and the shafts upon which commutators X Y Z are mounted at each of said stations rotate synchronously, such synchronous motion being obtained by regulating means as described by me in application, Serial No. 104,614, filed April 25, 1902, whereby the several brushes are at the same instant in the same angular position and relation with respect to the several segments of the several commutators, or having the several brushes mounted upon yokes capable of angular adjustment and with the shafts running at very closely uniform speed, as may be easily obtained, a manual adjustment may be made of such brushes as to their angular positions, so as to come into exact synchronism with the other stations. This method is equally feasible with the true synchronizing method disclosed in my application referred to and can be as readily performed as the synchronizing adjustments are made in power systems.

The operation of my system is as follows: The shaft 33 and the shaft-carrying commutators X Y Z rotate at a speed so that contacts 16 17 and 21 22 engage each other several times during the period allotted to the shortest code character, and likewise the several brushes bearing upon the said commutators make engagement with the segments of said commutators several times during the period corresponding to the shortest code character, commonly a dot. The field of the motor M is bipolar, and in consequence the shaft 33 rotates at approximately the same rate as commutators X Y Z. This means that contact 22 may be engaged by contact 21 at the same instant, for example, that, at the distant receiving-station, the brushes 58 and 64 are in engagement with segments 66 and 53, respectively, and that contact 17 at the same time cannot be engaged by the contact 16, and at the distant station brushes 59 and 65 are bearing upon insulating material, and therefore only wave-responsive device 66 can at that instant be influenced by energy received upon A, and such energy is, of course, then under control of key 29. In other words, key 29 controls a transmitter one-half the time, and alternate with it key 25 controls a second transmitter, and while key 29 is controlling the energy, wave-responsive device 66 is only affected, and while key 25 is controlling radiated energy wave-responsive device 67 only is affected. During the depression of key 29, for example, for a period sufficient to make a dot of a code, contacts 21 and 22 come into engagement several times, thereby sending out several trains of waves to represent a dot; but at the same instant of the arrival of such trains of waves wave-responsive device 66 is in communication with the aerial conductor A, and therefore responds to key 29 only and records a dot by the action of relay 68 in controlling the usual recording apparatus. It is seen, therefore, that from a single aerial conductor there may be transmitted several non-interfering messages, and that at the receiving-stations and from a single aerial conductor may be received and recorded several non-interfering messages.

As shown in Fig. 1, with switch-arm B in contact with 2, the apparatus is receiving. To transform the station into a transmitter, it is simply necessary to move the switch-arm B into contact with 1.

It is to be understood that I do not wish to be limited to transmitting simultaneously two messages only, inasmuch as my system can be readily expanded to transmit three or more messages simultaneously and likewise to receive them. Neither do I wish to be limited to the precise arrangement of circuits herein described, as obvious changes may be made without departure from the spirit or scope of my invention, and it is to be further understood that my system is applicable to those systems employing a plurality of aerial conductors or single aerial conductor, or to those systems in which aerial conductor A connects to earth or where a plurality of them are connected to earth.

What I claim is—

1. In a wireless signaling system the combination at the several stations thereof, of synchronously-rotating commutators, one of said commutators controlling current-supply of a synchronous motor, a plurality of interrupters alternately controlled by said motor, and a plurality of operator's keys controlling the circuit including said interrupters.

2. In a wireless signaling system the combination of a synchronous motor controlled by synchronously-rotating commutators, interrupters controlled by said motor, generators of radiant energy controlled by said interrupters and a plurality of operator's keys for controlling the circuit of said interrupters.

3. In a wireless signaling system, a plurality of stations, synchronously-rotating commutators at said stations, a plurality of wave-responsive devices brought successively into communication with the receiving-conductor, a plurality of generators at each station, means controlled by a commutator at each station for rendering said generator successively operative, and an operator's key controlling each generator.

4. In a wireless signaling system, synchronously-rotating commutators, a commutator at each station for controlling a plurality of generators, an operator's key controlling each generator, and electrodynamic means for regulating the speed of the commutators.

5. In a wireless signaling system, a motor, electrodynamic means controlling the speed of said motor, a plurality of commutators driven by said motor, a plurality of wave-responsive devices brought successively into communication with the receiving-conductor by said commutators, and signal-producing means controlled by said wave-responsive device.

6. In a wireless signaling system, a uniformly-rotating commutator, a synchronous motor controlled thereby, a plurality of generators, and means controlled by said synchronous motor for bringing said generators alternately and successively into operation.

7. In a wireless signaling system, a source of energy, a uniformly-rotating commutator for controlling the supply of said energy to a synchronous motor, a plurality of generators, and means controlled by said synchronous motor for rendering said generators successively operative.

8. In a wireless signaling system, a plurality of commutators, a plurality of wave-responsive devices brought successively into circuit thereby, a shaft rotating at a definite rate with respect to said commutators, a plurality of generators, and means controlled by said shaft for rendering said generators successively operative.

9. In a wireless signaling system, a plurality of generators, an interrupter in the circuit of each generator, and means for controlling said interrupter whereby said generators are rendered successively operative.

10. In a wireless signaling system, a plurality of generators, an operator's key controlling each generator, an interrupter in the circuit of each generator, and means for controlling said interrupters whereby said generators are rendered successively operative.

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