F. S. McCULLOUGH.

WIRELESS ELEVATOR SIGNALING SYSTEM.

APPLICATION FILED JAN. 22, 1917.

1,318,165.

Patented Oct. 7, 1919.

2 SHEETS—SHEET 1.

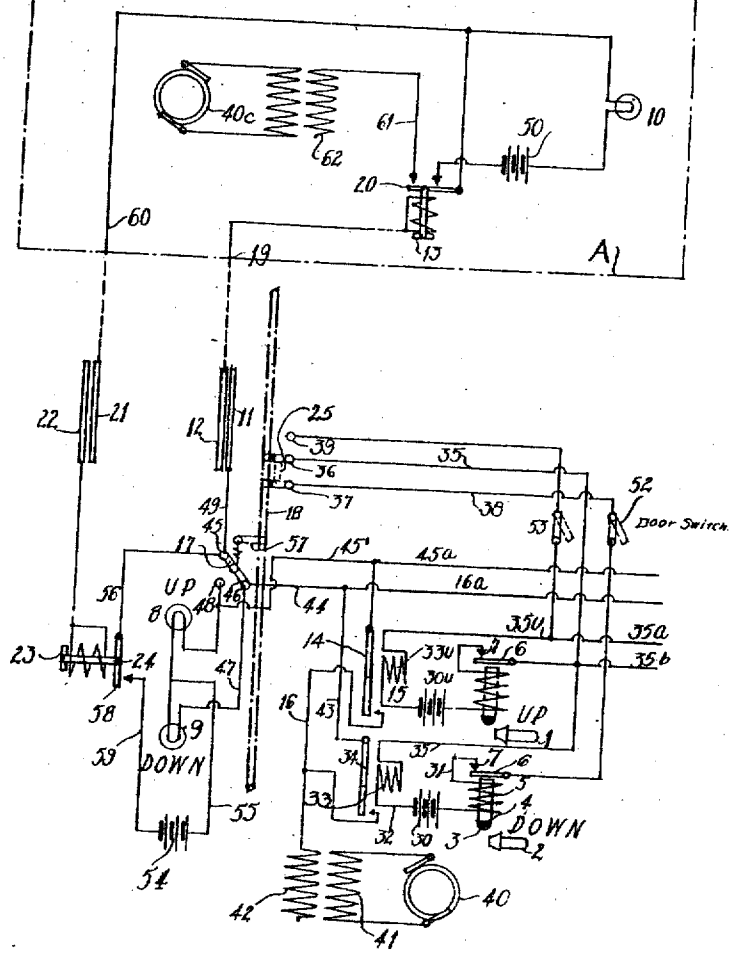


FIG. 1

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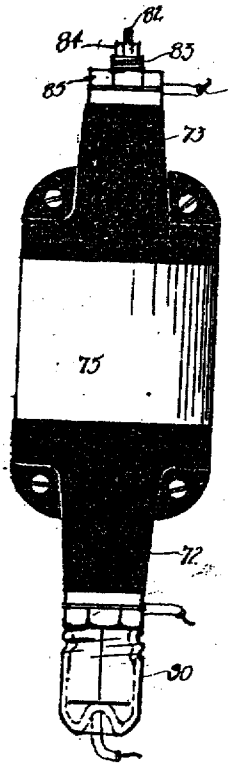


FIG. 2.

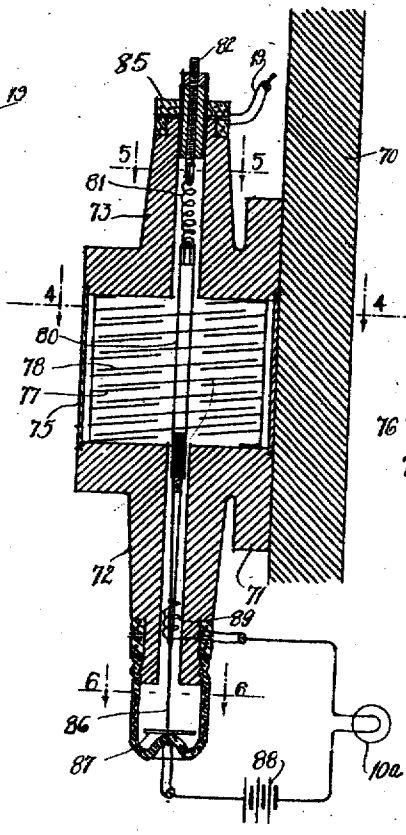


FIG. 3.

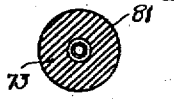


FIG. 5.

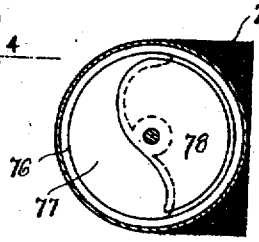


FIG. 4.

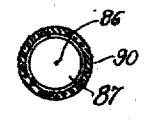


FIG. 6.

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UNITED STATES PATENT OFFICE.

FREDERICK S. McCULLOUGH, OF CLEVELAND, OHIO, ASSIGNOR TO GLENN L. MARTIN, OF CLEVELAND, OHIO.

WIRELESS ELEVATOR-SIGNALING SYSTEM.

1,318,165. Specification of Letters Patent. Patented Oct. 7, 1919.

Application filed January 22, 1917. Serial No. 143,560.

To all whom it may concern:

Be it known that I, FREDERICK S. McCULLOUGH, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Wireless Elevator-Signaling Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to a wireless signaling system, and is herein shown and described as embodied in a system for signaling elevators. An essential object is to provide a simple, efficient means for actuating signals in elevator cars and on the various floors of the building, and which shall be comparatively cheap to manufacture and not liable to get out of order. I accomplish the above object by constructing a system which eliminates a very large portion of the wiring necessary for the present signal systems and I greatly reduce the apparatus required. My invention avoids the necessity of connecting the elevator with the floors by wires.

In carrying out my invention I use a high frequency generator preferably connected by a single wire with capacity members arranged at the several floors for one elevator car or a plurality of elevators in a bank. I arrange capacity members on the car adapted to be brought into proximity with the successive capacity members for the floors so that when a signal switch is actuated on any floor it may connect the corresponding capacity member with the generating means and cause energy to be transmitted across the air dielectric from one capacity to the other while they are adjacent, and I arrange on the elevator car a relay adapted to be actuated by the electric impulse passing from one capacity to the other. This relay may control a visual or audible signal on the elevator car.

To make the system more complete I may arrange an additional capacity plate on each car at each floor and a relay on each floor to actuate a signal indicating that a car is about to respond to the signal of the waiting passenger. Other objects of my invention are to so arrange such a signal system that it may entirely avoid interference or confusion of signals or loss of energy. This has heretofore been one of the obstacles encountered in such signal systems, owing to the large amount of metallic work of the elevator cars, shafts, etc.

The wireless transmission of signals, as heretofore accomplished, depends upon a conducting sheet or surface as the surface of earth upon which the ether waves generated by the apparatus may act and it is well known that any objects intermediate the sending and receiving stations may obliterate or absorb the energy and interfere with successful signaling. With my system I use the energy which surrounds a single wire connected with the source and cause it to cross an air dielectric of a certain distance by the use of a predetermined frequency corresponding to such air distance, and thereby avoid any danger of interference or absorption and render commercially practical the signaling of elevators by wireless transmission.

My invention is hereinafter more fully described in connection with the drawings which illustrate a convenient arrangement thereof, and the essential characteristics of the invention are set forth in the claims.

In the drawings, Figure 1 is a diagram of a single unit of the system; Fig. 2 is a side elevation of the relay; Fig. 3 is an axial section thereof; Fig. 4 is a transverse horizontal section taken substantially on the line 4—4 of Fig. 3; Fig. 5 is a similar section taken substantially on the line 5—5 of Fig. 3; Fig. 6 is a section on the line 6—6 of Fig. 3.

Fig. 1 diagrammatically illustrates a single unit of the invention, it being understood that a similar arrangement of my apparatus may be adapted for as many additional cars as desired. On each floor I provide the usual push button switches for up and down signals, as indicated at 1 and 2 respectively. These signals are preferably provided with means for normally holding them in operating position until a complete signal has been effected. For example, the push buttons may be small plungers tapered at their inner ends to engage the insulated ends of vertically movable solenoid cores 4 of the solenoids 5. The upper end of these cores engage and operate switches 6 coacting with a contact 7, whereby when the coils are energized the solenoids hold these switches in closed positions and release them upon deenergization of the

coils. These coils are each in short signal circuits for the up and down signals and on the various floors (preferably all those except the top and bottom). I arrange visual signals comprising electric lights 8 and 9 for the up and down signals respectively, and within each elevator car I provide a signal light 10.

In the diagram the circuit for the down button includes a wire 31 connecting the contact 7 and the coil which is connected at its other terminal with the battery 30 from which a wire 32 leads to a magnetic coil 33 actuating an armature 34. From the coil 33 a wire 35 leads to a contact 36 adapted to be connected with a contact 37 by a bridge 25 carried by a vertically shiftable rod 18 moved by the elevator at each end of its travel to cause this bridge to render operative circuits for the button corresponding to its direction. A wire 38 leads from the contact terminal 37 to the switch 6.

At 40 is indicated a high frequency generator which is connected with a coil 41, the primary of a transformer having a secondary coil 42. This coil is arranged to generate waves of a predetermined frequency and its oscillations are undamped. A wire 16 is connected with one terminal of the coil 42 and has branch contacts adapted to be engaged by the switches 34 and 14 for the up and down signals. Leading from the switch 34 is a wire 43 adapted to connect by a wire 44 with a terminal, shown as pivoted at 45 and coacting with terminals 46 and 48. A wire 49 leads to a capacity plate 11 which is preferably in the form of a narrow ribbon mounted in the elevator shaft. At A is indicated, in dot and dash lines, the car in which is mounted the signal light 10 controlled by a local circuit including the battery 50 and governed by an armature switch 20 under the control of the relay, indicated at 13, which is of a special construction to be hereinafter described. The relay 13 is connected by the wire 19 with a capacity plate 12 adapted to pass in proximity to the several capacity plates 11 of the series in the elevator shaft.

The operation of the circuit so far described is as follows: On the actuation of the plunger 2, the solenoid is moved upwardly actuating the switch 6 closing the circuit described, leading through the coil 5, battery 30, magnetic coil 33 and bridge 25, and the solenoid remains up holding the switch closed. The coil 33 closes the armature 34 against the contact of the wire 16, whereby the transformer is connected with the capacity plate 11 through the wires 43, 44, switch 17 and wire 49. This causes a field of energy to surround the latter wiring connection and capacity plate, which energy is transmitted to the capacity plate 12 when it comes opposite the capacity plate 11 and thence to the relay 13, actuating the switch 20 and notifying the operator in the car, a suitable distance in advance of the floor at which the button 2 was actuated, by causing the light 10 to become incandescent.

To break the button circuit and permit the switch 6 to open at the proper time, I provide the usual switch indicated at 52 which is opened by the door of the elevator in the usual manner. This permits the switch 6 to open after which the door switch is again closed by gravity or a spring, as desired.

A similar circuit for the up buttons is provided including the battery 30^u, coil 33^u, actuating the armature 14 and wire 35^u leading through the switch 53 to the contact 39 and thence back through the bridge 25 and wire 35, which is also connected with the switch 6 for the up signal circuit. Thus, when the rod 18 is moved upwardly by a bumper, not shown, actuated by the car, only the up signal on any of the floors will be operated for the car of the corresponding shaft.

When either of these push button circuits is energized the corresponding up or down light on the proper floor is lighted as the car approaches that floor and receives its signal. To accomplish this, I provide a local circuit for these lights including a battery 54 connected by a common wire 55 which is branched through the two lights of the two contacts 48 and 46, heretofore mentioned and either of which may connect with the switch 17, connected at 45 with a wire 56 leading to an armature 58 coacting with a contact connected by a wire 59 with the battery 54. The switch 17 is shown as having a connection at 57 with the vertically movable rod 18 whereby it coöperates with the proper contact 48 or 46 corresponding to the direction in which the car is moving. As shown, it stands in position to actuate the down light 9 whenever the switch 58 is closed.

This answering signal is actuated by closing the switch 58 through a relay similar to the relay 13 and connected with a capacity 22 at the proper distance from the floor, which in turn receives energy from the capacity 21 carried by the car and connected by the wire 60 with the switch 20 which is in turn connected by a wire 61 with the coil 62 of a transformer and generator 40^c carried by the car. By this arrangement it will be seen that when the switch 20 is actuated to signal the car at the same time this switch connects the generator with the capacity 21 and transmits energy to the relay 23 governing the floor signal light.

The signal to the elevator actuated when the car is moving upwardly is controlled by the switch 14 which may contact with one of the contacts of the wire 16 and which is connected by a wire 45′ with the terminal 48.

From the foregoing description it will be seen that the arrangement of wiring is very simple compared to that of wire signaling systems. It is to be understood that the circuits illustrated for the push buttons and lights are very short circuits, the wires of which are inclosed in small box mountings, there being only short connections to the bridge switch 18, while the wires 35^a, 35^b, 16^a and 45^a indicate leads connecting these circuits to those of other units.

The operation of my device depends upon the relays 13 and 23 which are so constructed as to be actuated by that form of energy which surrounds a wire connected with one terminal of a high potential transformer connected with a high frequency generator and which energy does not depend for its existence upon any return or ground wires. I have found in actual practice that such a relay can be actuated through a single wire so connected even when the wire is divided by capacity plates separated by an air gap of several inches. Thus by bringing such capacities together I accomplish the selective signaling described. One form of such a relay is illustrated in Figs. 2 to 6 inclusive and may be constructed as follows:

At 70 is indicated a suitable support on which is mounted a block or casing 71 preferably of insulating material. Two lateral extensions 72 and 73 of this casing are connected by a cylindrical member 75 which incloses a substantially cylindrical space communicating with axial bores of the extensions 72 and 73. Within this space is mounted a cylindrical cage 76 carrying transverse leaves 77 somewhat spirally arranged, as indicated, and comprising light thin sheets of metal. At 78 are indicated coacting wings adapted to be interposed between the leaves 77 and carried on a revoluble and vertically movable spindle 80 shown as supported by a spring 81 at its upper end adjustably carried by a screw 82, threaded through a sleeve 83 to which it may be locked by a nut 84. The sleeve 83 is externally threaded and emphasized by a nut 85 which may provide a binding post for the wire leading to the relay and corresponding to the wire 19.

The spindle 80 is provided with a downward extension 86 insulated therefrom and adapted to contact with a plate 87 connected with a battery 88 which is included in one of the signal light circuits, the connection being made through a wire 89 which is so coiled about the extension 86 as not to interfere with its rotation or vertical movement. A suitable cap 90 supports the plate 87 and protects the contact 86.

This relay depends for its operation upon the attraction of one air electrode to another when charged with the energy which follows a wire connected with a source of high frequency current of a high potential. When the field of energy surrounds the wire leading to the relay the wings 78 are caused to move downwardly and turn slightly within the cage 76 by their attraction to the leaves 77. This action occurs when the capacity plates are in proximity and after the energizing of one of the push button signal circuits which causes the relay to make a contact at 86 and 87, whereupon the light 10^a becomes incandescent.

I found by experiment that this relay may be constructed in many different ways, the essential features being an electrode attracted to some other object, and I have also found that the action may be augmented by the use of a small resistance wire which heats when the energy passes along the same. Accordingly I may make the coil spring 81 of such wire so that its expansion, due to the heating may increase and make more positive the movement of the relay contact.

From the foregoing description it will be seen that I have provided a wireless transmission signal system which is directive in its nature and adapted for many uses, and which depends only upon the use of a source of a high potential and a high frequency electric energy, a wire and a relay having the elements just described; and that such a system may be made directive and used for signaling one or more moving objects in parallel or divergent paths by the use of capacity members carried on the moving elements and along the paths, such capacity members being connected with the relay and source of current respectively. For elevator signaling I may use a high frequency generator and transformer so designed that they will not heat from constant use. Such generator and transformer are preferably adapted to be operated by city current, and I eliminate much mechanism, wiring and apparatus commonly used in the wire systems of signaling. Another feature of my system is that I use no rubbing contact plates to connect the elevator with the several floors.

Having thus described my invention, what I claim is:

1. In a system for signaling elevators, the combination of means for generating electric oscillations of high frequency, capacity members arranged to correspond to the different floors, a single direction conductor leading from said means to the capacity members, a corresponding capacity member carried by the elevator car, a relay connected with the second named member and adapted to be actuated by electrostatic stress following the conductor when the capacity plates are brought into proximity, and a signal circuit on the car controlled by the relay.

2. In a wireless elevator signal system, the combination with manually controlled signal circuits on each floor for indicating up and

down directions, a high frequency generator and a transformer, capacity members arranged to correspond to the various floors and a capacity member carried by the car, single conductor connections between the first mentioned capacity plates and the transformer, said first mentioned circuits controlling said connections, a relay adapted to be actuated by electrostatic stress and requiring no return conductor and connected with the capacity plate on the car, and a signal circuit on the car controlled thereby.

3. In a wireless elevator signal system, the combination with manually controlled signal circuits on each floor for indicating up and down directions, a high frequency generator and a transformer, capacity members arranged to correspond to the various floors and a capacity member carried by the car, connections between the first mentioned capacity members and the transformer, said first mentioned circuits controlling said connections, a relay adapted to be actuated by electrostatic stress and requiring no return conductor and connected with the capacity plate on the car, a signal circuit on the car controlled thereby, up and down signals on the various floors, additional capacity plates, a generating means on the car, and a relay similar to said first mentioned relay for controlling the last mentioned signals.

4. In a wireless elevator signal system, the combination with manually controlled signal circuits on each floor for indicating up and down directions, a high frequency generator and a transformer, capacity members arranged to correspond to the various floors and a capacity member carried by the car, connections between the first mentioned capacity members and the transformer, said first mentioned circuits controlling said connections, a relay adapted to be actuated by electrostatic stress and requiring no return conductor and connected with the capacity plate on the car, a signal circuit on the car controlled thereby, up and down signals on the various floors, additional capacity members, a generating means on the car, and a similar relay for controlling the last mentioned signals, the signals on the various floors being actuated simultaneously with the signal in the car and governed by its relay.

5. In a wireless elevator signal system, means for generating high frequency oscillations, capacity members arranged to correspond to the various floors and a capacity member carried by the car, conductor connections between the first mentioned capacity plates and the transformer, means for controlling said connections to govern the signals, a relay adapted to be actuated by electrostatic stress and requiring no return conductor and connected with the capacity member on the car, a signal circuit on the car controlled thereby, floor signals, additional capacity members, a generating means on the car, and a second relay similar to the first mentioned signals, the signals on the various floors being actuated simultaneously with the signal in the car and governed by its relay.

6. In a wireless elevator signal system, the combination of a single direction conductor, means for generating electric oscillations connected therewith, a signal member on the elevator car, and capacity plates adapted to be brought into proximity by the travel of the elevator to cause the signal member to be actuated.

7. In a wireless system for signaling elevators, the combination of means for generating electric oscillations, a single direction conductor leading therefrom and connecting with capacity members corresponding to the different stops of the elevator car, a capacity member on the car, a relay connected therewith and actuated by electric energy transmitted thereby when the capacity members are brought into proximity.

8. In a system for signaling elevators, the combination of a high frequency generator, a transformer connected therewith adapted to transmit undamped electric oscillations, a single conductor adjacent the path of the elevator and the capacity members at intervals along the same, a relay on the elevator car adapted to be acted upon by such oscillations without a return conductor when brought into proximity with one of the capacity members.

9. In a system for signaling elevators, the combination of means for generating electric oscillations, a conductor leading from said means along the path of the elevator car, there being no return conductor, a relay on the elevator car, including an air electrode adapted to be moved by electrostatic stress, a signal governed by such movement, and means connected with the relay and the conductor and adapted to increase such stress when brought into proximity by the movement of the elevator car.

10. In a device for use in signaling elevators, in combination, a high frequency generator, a transformer, the secondary coil of said transformer having a wire connected thereto, branches on said wire for up and down signals, switches for throwing corresponding branches of said wire into circuit, up and down signal lamps connected respectively each to a circuit, push buttons for up and down signaling, a generator, solenoids connected each to a push button, and means whereby when a button is pushed a circuit is closed from the generator through a solenoid and a corresponding switch in the high frequency circuit is actuated to close that circuit through a signal lamp.

11. In a wireless system for signaling ele-

vators, in combination, a high frequency generator, a conductor leading therefrom, a capacity plate connected to said conductor, a push button adapted to actuate a switch in the circuit leading to the capacity plate, a second capacity plate, one of said plates being on the elevator, the two plates being arranged so that when the elevator passes they come into close proximity, and means connected with the other of said plates adapted to switch on a signal lamp in the elevator when the plates are in proximity as aforesaid.

12. An elevator, a signal lamp thereon, a generator of high frequency on said elevator, a conductor leading from the high side of said generator, a capacity plate connected thereto, a second capacity plate arranged so as to be near the first when the elevator approaches a landing, a conductor, a high frequency generator from the high side of which said conductor leads, a signal lamp in said circuit, a push button, means connected with said push button for closing the circuit to the second plate, and means for holding said circuit closed until the elevator reaches a landing, whereby, when a button is pushed, the car is signaled and as the car approaches a landing, its direction is signaled.

13. In a wireless elevator signal system, in combination, a single direction conductor, a high frequency generator, to which said conductor is connected, an elevator car, an electrically actuated signal on said car, a fixed capacity plate on said car connected with said signal, a capacity plate to which the single direction conductor is connected, near the path of traverse of the car, and means whereby when current is sent to the said fixed plate the signal, when the plates pass, is enabled to function.

14. In a wireless system for signaling elevators, in combination, a generator, a single conductor leading from said generator, a capacity member forming the terminal of said conductor, and switch means whereby circuit may be established to the capacity plate, an elevator car, an electric lamp on said car, a generator for said lamp, a high frequency current generator on the car, a conductor and a capacity plate on the car, the latter arranged to pass near the first mentioned plate, whereby when current from the generator first-named is sent to the first-named capacity plate, the lamp in the car, when the latter in its traverse brings the two plates opposite each other, will be made to glow.

In testimony whereof, I hereunto affix my signature.

FREDERICK S. McCULLOUGH.