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C. W. MAHON.

COIN CONTROLLED TELEPHONE SYSTEM.

APPLICATION FILED SEPT. 6, 1904.

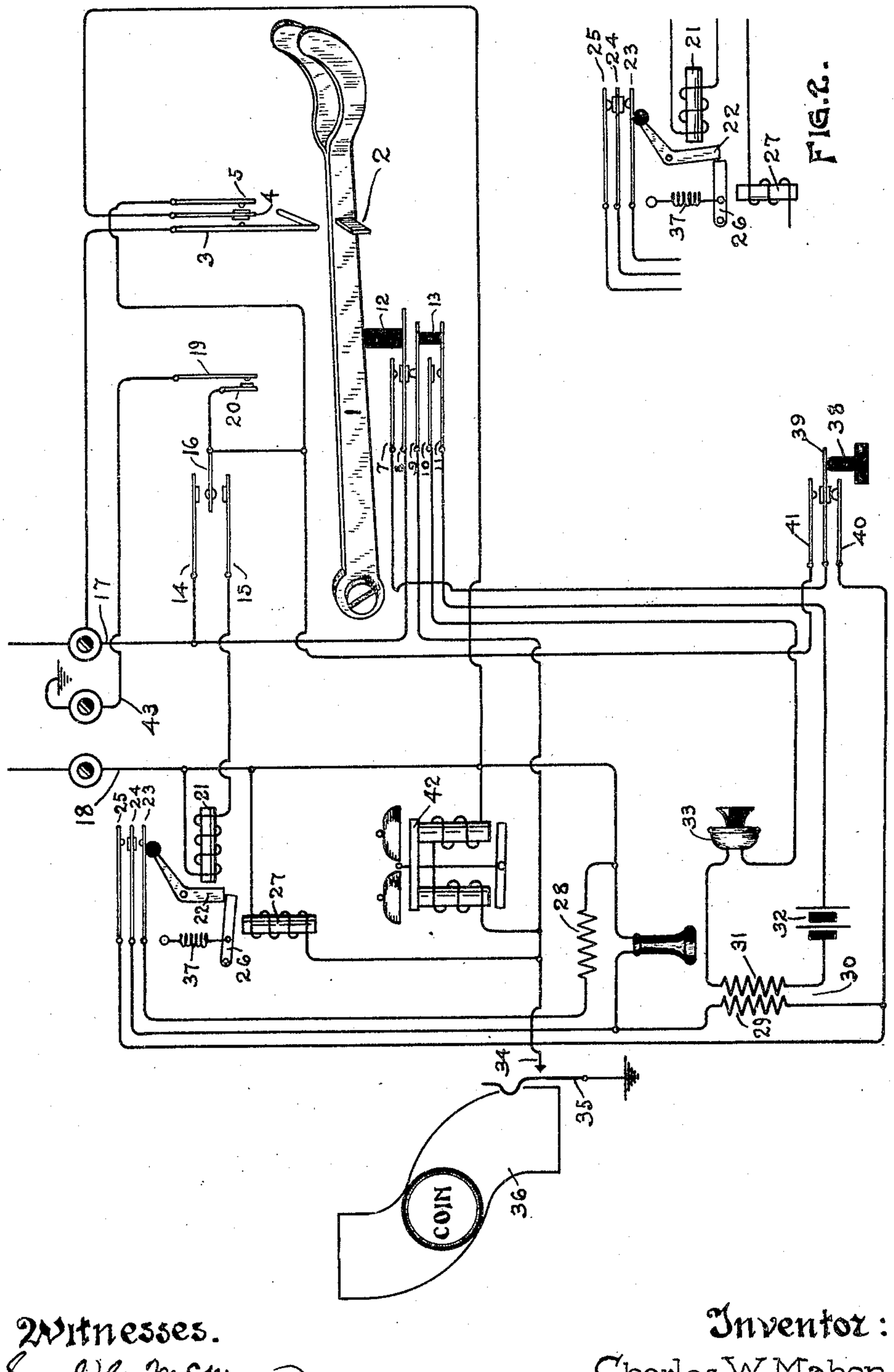

FIG. 1.

FIG. 2.

Witnesses.
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UNITED STATES PATENT OFFICE.

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COIN-CONTROLLED TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 789,925, dated May 16, 1905.

Application filed September 6, 1904. Serial No. 223,331.

To all whom it may concern:

Be it known that I, CHARLES W. MAHON, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Coin-Controlled Telephone Systems, of which the following is a specification.

My invention relates to that class of telephone systems in which the payment for the service is made by the user depositing a coin or token in a mechanism associated with the telephone. In some of the systems already in use involving this method of payment it is necessary to deposit the coin as a means of giving a signal to the operator in the central office. In this arrangement there is the objection that, because of some imperfection in the condition of the telephone or of the line or of the central-office apparatus, it may be impossible to display the signal even though the coin be dropped, and thus the subscriber may make the prepayment without receiving the service, the coin or token then being beyond his recovery. In other systems it is intended that the coin shall be deposited at the request of the operator after the connection is established. There is an objection in this method in that the attention of the operator is required after she has made the connection and called the subscriber, so that she may collect the coin by electrical means if the conversation occurs and may return it to the subscriber by electrical means if no conversation results.

In many localities telephone systems having switchboards manually operated are being superseded by systems equipped with automatic apparatus in which the connections between the lines are established by automatic switches controlled and directed over the line through electrical means by the subscriber. As in such systems there is no signal to be set before an operator and there is no operator to collect or return the coin at the time of conversation, it is evident that methods adapted to the manual are not adapted to the automatic systems.

The object of my invention is to enable a subscriber whose station is equipped with mechanism operating in conjunction with automatic mechanism to connect his line with that of a desired subscriber and to cause the calling subscriber to deposit a proper coin or token in the coin-collector if he secures the conversation for which the charge is made. I attain these objects by means of mechanism and circuits illustrated in the accompanying drawings, in which—

Figure 1 shows the circuits and mechanism of the telephone set, and Fig. 2 one of the positions of an interlocking relay.

I show the essential features of my invention associated with the circuit of a telephone-substation set of the type adapted to be used with the automatic telephone system of most general employment. In this system current impulses are sent over the line to direct and control mechanism in the central office electrically associated with the line. As the sole object of these impulses and the operations they control in the central office is to connect the line of the calling subscriber with that of the desired correspondent, I do not illustrate the mechanism in the central office, but show merely the means existing at the substation to accomplish this result.

In Fig. 1 of the drawings, 1 is a hook-switch lever. It is provided with a projection 2 so formed and so related to the spring 3 that when the hook passes upward upon the removal of the receiver from it it will cause no contact between the springs 3, 4, and 5, but when the hook moves downward when the receiver is hung on it it will move the spring 3 into contact with the spring 4 and that into contact with the spring 5, crossing the three together. The hook-switch lever 1 also is related to the springs 7 to 11, inclusive, in such a way that it makes and breaks contacts among them by its motion. When the lever is up, there is contact between the springs 7 and 8 and between the springs 10 and 11. When the hook is down, there is contact between the springs 8 and 9. The set and adjustment of the springs and the existence of the insulating-pieces 12 and 13 enable these contacts to be made and prevent others.

The springs 14 and 15, arranged to make independent contacts with the point 16, are those which are controlled by the signal-sending mechanism at the subscriber's station, by which contacts he secures connection with the desired line. I have omitted from the drawings elaborate illustration of the mechanical means of controlling the contacts between the pieces 14 and 16 and 15 and 16. The operation of calling is merely to make successive contacts between the spring 14 and point 16 as many in number as there are units in the digit of the number called, following each series by one contact of the spring 15 upon the point 16. This will send first a series of impulses over the line-wire 17, ending with one impulse over the line-wire 18. This will be repeated for each digit. For instance, if the number called is "2,342" there would be four series of impulses, the first one being two contacts of the spring 14 with the contact 16 followed by one contact of the spring 15 with the contact 16, then a second series of three contacts on the part of spring 14 followed by one on the part of spring 15, then a series of four contacts on the part of the spring 14 followed by one on the part of spring 15, and, lastly, two contacts on the part of spring 14 followed by one contact on the part of spring 15. The impulses which result from these contacts are caused by current from a source of energy in the central office, and, as I here show, the conditions are with reference to the ground. The ground connections of the impulse-transmitting device just described are established by contact between the spring 19 and the point 20, the spring 19 being wired to the ground-wire 43. This contact is normally open, but is made as an immediate preliminary to the sending of any impulse on the part of the subscriber. The connection between the spring 19 and the point 20 is not broken until the receiver has been restored to its hook at the completion of the conversation. For the sake of clearness I omit this element of mechanism also from the drawings, as it is in general commercial use.

Upon the completion of a series of current impulses to establish a connection the pressure of the ringing-button 38 causes the spring 39 to break from the contact 40 and make with the contact 41. Under the conditions which exist this will place a ground upon the line-wire 17, and the central-office mechanism being adapted for the purpose this impulse will cause the ringing of the bell of the desired subscriber.

In the present actual use of the automatic telephone system having these features impulses are sent over the wires of the line directly. For the purpose of my invention I include the winding of a relay 21 in one of the impulse-circuits from the contact-spring 15 to the line conductor 18 in the drawings. The relay 21 is equipped with an armature 22, adapted when actuated to connect together the three springs 23, 24, and 25. The armature is also mechanically so related to armature 26 of an electromagnet or relay 27 that when it has moved to effect the contact mentioned it will be locked in position and prevented from falling back to break the contacts between springs 23, 24, and 25 even though the winding of its relay 21 is deënergized. This condition is shown in Fig. 2. When it is recalled that no connection can be set up between two lines without an impulse being sent over the line-wire 18, it will be seen that one of the first things to happen in setting up a connection will be to energize the relay 21. As this closes together the springs 23, 24, and 25, these circuit relations will be established at the beginning of each attempt at conversation and will exist throughout the connection unless the armature 22 is set free by a further action. The circuit relations established by the contact between the springs 23, 24, and 25 are two—first, by contact between springs 23 and 24 a low-resistance and non-inductive shunt 28 is placed around the telephone-receiver. This is of such relation to the resistance of the telephone-receiver itself as to carry when it is in shunt with the receiver so much of the voice-current which would otherwise pass through the receiver as to leave received speech only fairly audible, but sufficient for practical purposes. While the shunt 28 is of high enough resistance to enable speech to practically be received, it is of such low resistance that the comparatively feeble voice-currents which can be caused by speaking into the receiver as a magneto-transmitter will pass through it in large proportion relative to what will pass over the line. Conversation with a distant correspondent is thus impossible by speaking into the receiver. I find that with the ordinary commercial design of telephone-receivers the shunt 28 will be a practical one if of a resistance of about seven ohms; second, the contact between the springs 24 and 25 places a shunt of negligible resistance around the secondary winding 29 of the induction-coil 30. As voice-currents upon the line are caused by current variations in the primary winding 31 of the induction-coil 30 through the agency of the battery 32 and transmitter 33, there is no means of sending voice-currents from the transmitter over the line, while the secondary winding 29 is thus short-circuited; but the electromagnet or relay 27 is adapted to attract its armature 26 and draw it out of engagement with the armature 22 when current passes through its winding, and current will so pass when a ground is placed upon the contact-point 34 associated with the spring 35. The coin-chute 36, adapted to receive a coin or token deposited by the calling subscriber and carry it to the coin-receptacle, will cause the coin first to make a contact between the spring 35 and the point 34 and then to break

it. As the spring 35 is connected to ground, the point 34 will be grounded at the time of contact, the electromagnet or relay 27 will be energized, and the armature 26 will be drawn against the force of its retractile spring 37 out of engagement with the armature 22. The force of the springs 23, 24, and 25 will then cause them to break contact with each other and will force the armature 22 into a position wherein it will not be relocked by the armature 26 until its relay 21 has been reënergized. The conditions are thus again as shown in that part of Fig. 1 which illustrates these details.

The dropping of a coin being thus a means under the control of the subscriber for restoring conditions whereby he may speak to his correspondent prepayment for the conversation is insured, as while he may know that the called subscriber has responded, because he hears that response in his receiver, he may speak over the line neither by the use of his transmitter nor his receiver.

Upon the completion of the conversation the hanging up of the receiver will result in the crossing together of the springs 3, 4, and 5, sending current impulses over both wires of the line, releasing the mechanism in the central office, leaving it in readiness to receive another call.

I find it of advantage for harmonious operation of the various parts of the system to make the winding of the relay 21 relatively low. I have found thirty ohms to be a satisfactory and convenient resistance. Also I find it of advantage to have the winding of the relay 27 relatively high, and I find it satisfactory to make this resistance about one thousand ohms. The relay 27 and the ringer 42 being in shunt with each other, any currents which actuate the ringer will also actuate the relay 27, thus unlocking the shunts upon the telephone set in case they should exist at the time of receiving a call.

I do not desire to limit myself to the particular adaptation of my invention to the circuits of the automatic system which I have shown and described, as it is evident that by minor modifications it can be adapted to other systems in which central-office connections depend upon impulses over the line and even to still other systems in which connections are set up in other ways.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a coin-controlled telephone, transmitting-circuits, a receiving-circuit, an interlocking relay, and means whereby the interlocking of said relay will render the transmitter-circuits inoperative until said interlocking is released, substantially as described.

2. In a coin-controlled telephone, transmitting-circuits, a receiving-circuit, interlocking relays, means whereby said relays will be interlocked upon the making of a call, means whereby said interlocking will make said transmitting-circuits inoperative, and means whereby a deposited coin or token will release said interlocking, substantially as described.

3. In a coin-controlled telephone, a transmitting-circuit, a receiving-circuit, a coin-receiving device, a signal-receiving device, means whereby the transmitting-circuit may be rendered inoperative in the making of a call, means whereby the transmitting-circuit may be rendered operative by the deposit of a coin or token, and means whereby the operation of the substation signal-receiving device will render the transmitting-circuits operative, substantially as described.

4. In combination in an automatic telephone system, signal-sending elements, a transmitting-telephone, a receiving-telephone, a coin-collector adapted to receive a coin or token, means adapted to render said transmitting-telephone inoperative on sending a signal, an electromagnetic signal-receiver associated with said telephones, and means whereby the deposit of a coin or token, or the passage of current adapted to operate said signal-receiver, will render said transmitting-telephone operative, substantially as described.

5. In a coin-controlled telephone, transmitting-circuits, receiving-circuits, interlocking relays, electromagnetic means for locking one of said relays with the result of making said transmitting-circuits inoperative, and means for restoring said transmitting-circuits to operating condition by electromagnetically unlocking said interlocking relays through the agency of the payment of a coin or token, substantially as described.

6. In a coin-controlled telephone, a telephone-receiver, a telephone-transmitter, an induction-coil, a shunt-coil, a relay adapted to place said shunt-coil in electrical shunt with said telephone-receiver and to short-circuit the secondary winding of said induction-coil, an electromagnet adapted to lock said relay, a coin-collector adapted by the act of collecting a coin or token to release said relay from its locked condition, substantially as described.

Signed by me at St. Louis, in the State of Missouri, in the presence of two witnesses.

CHARLES W. MAHON.

Witnesses:
W. F. ROTH,
E. E. DEWEY.