

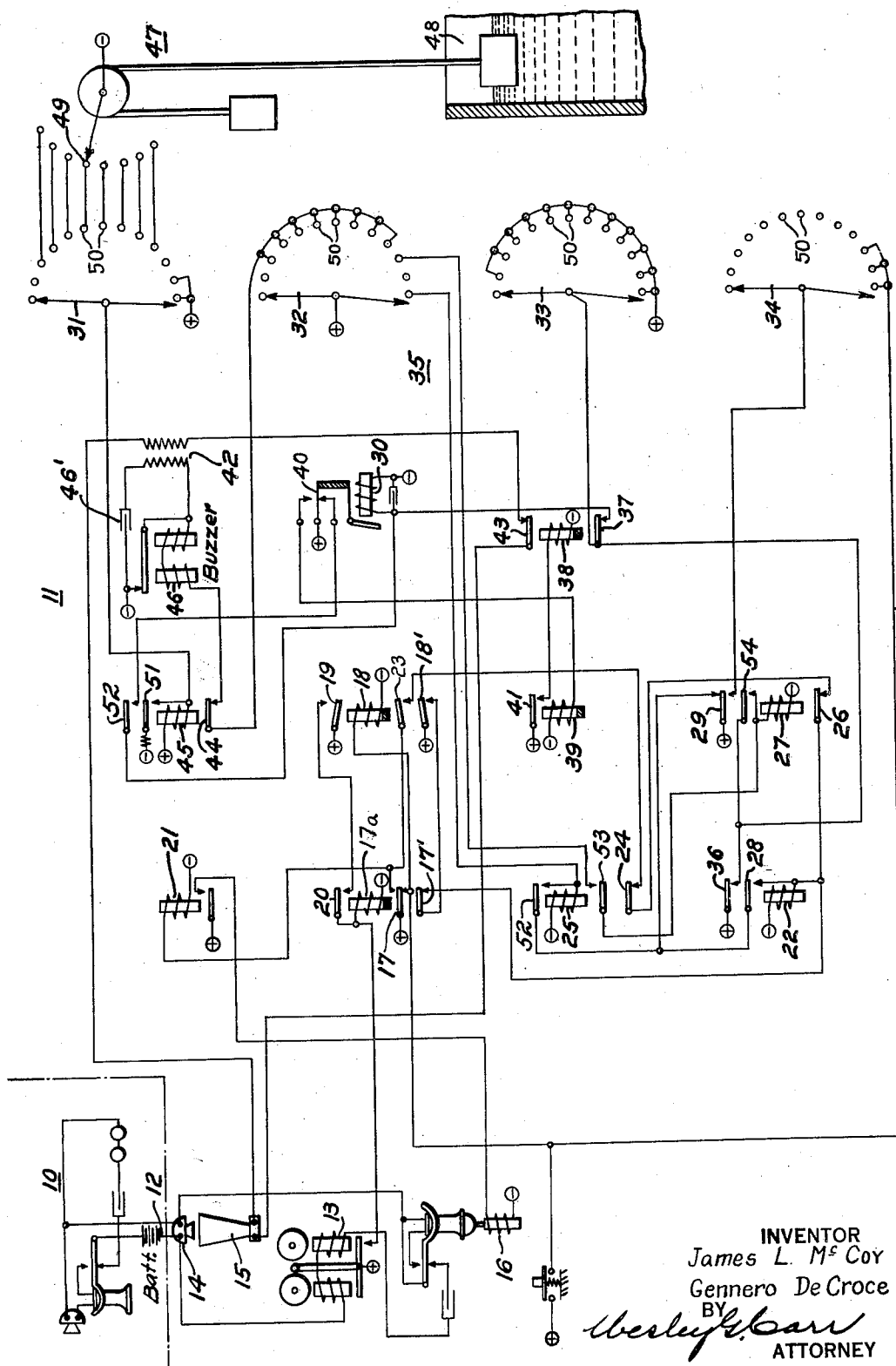
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TELEPHONOMETER

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TELEPHONOMETER

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Our invention relates to signalling systems and, in particular, to systems which are adapted to give an automatic response indicative of some condition at a point remote from the receiving end of the system.

With the increase in the number of automatic plants of various kinds that has occurred in recent years, a necessity has arisen for a signalling system which will indicate the condition of apparatus at a distant point to an operator at a central station. Numerous types of signalling systems have already been proposed but are subject to certain disadvantages.

We have decided that, since practically every distant station or plant is connected with its control center by telephone circuits, the signalling necessary to be carried on between the distant station and the central station may well be transmitted over existing telephone circuits.

It is an object of our invention, therefore, to provide automatic means for transmitting an indication of the condition of a piece of apparatus in a distant station, over telephone circuits, in response to a telephone call originated at a central station.

Our invention, in its broader aspect, has for another object the provision of a telephonic system of remote metering.

It is a particular object of our invention to make use of standard telephone instruments and existing circuits for the transmission of meter readings or other similar information.

In accordance with our invention, we provide a simple system for automatically producing a code of sounds in accordance with the reading of a meter or register at a distant point, for transmission over telephone circuits. Our invention includes means responsive to the operation of the ringer of the telephone bell in the distant station for lifting the telephone receiver thereat and initiating the operation of the code-sending equipment.

A thorough understanding of our invention may best be obtained by a study of the accompanying drawing in connection with the following description thereof.

The single figure of the drawing is a diagrammatic illustration of the apparatus and circuits necessary in an embodiment of our invention.

Referring, in detail, to the drawing, our invention comprises a control station 10 and a distant station 11. It is contemplated that automatic apparatus will be installed at the distant station and, in the particular example of our invention described, it is assumed that the distant station is an automatic hydro-electric generating or pumping station. In such installations, it is desirable for an operator at a central station to be able to check the water level available for generation of power or other purposes, although it is obvious that our system may be applied to the transmission of indications other than that mentioned.

The central station and the distant station are connected by telephone circuits 12, the apparatus included in which is indicated schematically and comprises the usual transmitter, receiver, hook switch and ringer. The distant-station telephone set includes the same apparatus, the ringer 13 being shown in more detail in order to explain the operation of the signalling system. In connection with the sub-station telephone transmitter 14, a speaker 15 is illustrated, the purpose and function of which will appear hereinafter. A solenoid 16 is provided for lifting the receiver of the sub-station telephone from its hook to establish communication between the two stations in response to a call from the central office, as will be explained later.

The remainder of the apparatus shown in the drawing will be described in connection with the following explanation of its operation.

Let it be assumed that the operator at the central station desires to check the water level at the distant station. In such case, he will place a call for the distant-station telephone through the standard telephone system, either by calling an operator or by dialing the correct number, depending upon whether the telephone system is of the manual or machine-switching type. When a

circuit has been established through the telephone exchange between the central station and the distant station, the ringer 13 at the distant station will be energized by alternating current in the well known manner.

5 When the armature of the telephone ringer at the substation vibrates, it will engage an associated contact momentarily to establish an obvious energizing circuit for a relay 17a. The relay 17a, as indicated by the
10 shaded end of the core thereof, is of the slow-release type. A slow-release relay is a relay that does not release its armature until a short time after its coil is deenergized. This provision makes it impossible to start
15 the system as a result of an accidental momentary energization of the relay 17a.

When the ringer 13 operates, the relay 17a actuates its contacts. The operation of the relay 17a interrupts, at the contact 17,
20 a normally closed holding circuit for a relay 18 which is energized so long as the code-sending equipment is idle. The relay 18 is also a slow-release relay and, after a short interval, releases its contacts. This
25 operation results in the completion of a locking circuit for the relay 17a, including the contact 19 of the relay 18 and the contact 20 of the relay 17a.

30 An obvious energizing circuit is simultaneously completed through the contact 17 of the relay 17a, for the relay 21. A similar circuit is completed for the relay 22, including contact 17 of the relay 17a, contact 23
35 of the relay 18, contact 24 of a relay 25, contact 26 of a relay 27 and the winding of relay 22. At armature 17', the relay 17a interrupts a circuit to relay 22 for a purpose to be explained later. Armature 18' of relay
40 18 connects positive battery terminal to this circuit but only after it has been opened at armature 17'.

The relay 21, when energized, completes an obvious energizing circuit for the solenoid 16 which is adapted to lift the receiver
45 of the sub-station telephone.

The relay 22, when energized, completes a locking circuit for itself through its contact 28 and the contact 29 of the relay 27,
50 although its original energizing circuit is maintained until relay 25 operates. The operation of the relay 22 also completes a circuit for a stepping magnet 30 which is adapted to step the wipers 31, 32, 33 and 34
55 of a selector switch 35 from one of their associated contact points to the next. This circuit includes the contact 36 of the relay 22, the contact 37 of a relay 38, and the winding of the stepping magnet 30.

60 When the stepping magnet 30 is energized, the selector switch prepares to advance its wipers from their first to their second contacts and a circuit is simultaneously completed for a slow-release relay 39
65 at the contact 40 of the magnet 30. After

a short interval of time, the slow-release relay 39 is energized and, in turn, completes an energizing circuit for relay 38 at contact 41. Relay 38, when energized, interrupts the circuit for the stepping magnet 30 at its contact 37. The relay 38, at its
70 contact 43, simultaneously interrupts a circuit including the secondary winding of a transformer 42 and the speaker 15 for a purpose that will be explained later.

75 When the stepping magnet 30 is deenergized, the wipers 31, 32, 33 and 34 of the selector switch 35 are advanced one step, and the energizing circuit for the relay 39 is interrupted at the contact 40 of the stepping magnet. The stepping magnet is again energized, as previously explained, and, at the contact 40, completes the circuit for the relay 39 a second time. The relay 39 is again energized to complete a circuit for
80 relay 38 which interrupts the circuit of the stepping magnet at armature 37, and this alternate energization of the relays continues, thus slowly stepping the wipers of the switch from point to point.

85 When the wipers engage their third contacts, a circuit including the wiper 32, the contact 44 of a relay 45 and its back contact, a buzzer 46, the primary winding of the transformer 42, and a condenser 46', is momentarily completed. A sound impulse is thereby produced at the sub-station telephone transmitter by the speaker 15 which is connected to the secondary winding of the transformer 42 and the contact 43 of relay 38. In accordance with the foregoing
90 description of the operation of the selector switch, the contact 43 of the relay 38 is released after every step of the switch, and the time delay in the release of said armature is adjusted to permit the circuit for the speaker 15 to be completed before the selector switch advances another step. Successive impulses will thus be produced
95 by the continued operation of the selector switch to indicate the position of a float switch 47 which is shifted in accordance with the level of water in the forebay or storage basin 48. The production of sound impulses will be stopped when the indication has been transmitted, in the following
100 manner.

105 Assume that the float switch 47 is in engagement with the contact 49 thereof, when the wiper 31 of the selector switch 35 engages its corresponding contact 50, a circuit will be established for the relay 45. The operation of the relay 45 completes a locking circuit therefor at its contact 51, interrupts the circuit to the buzzer 46 at its
120 armature 44 and, at its armature 52, closes a spinning circuit for the stepping magnet 30, including the winding thereof, the contact 52 and the contact 40 of the stepping magnet. The production of sound impulses
130

by the buzzer 46 is thus stopped and the selector switch is rapidly advanced from point to point without the time delay introduced by the relays 38 and 39 between steps, since the stepping magnet interrupts its own circuit.

It is believed to be apparent, from the foregoing, that the number of sound impulses produced depends on the position of the float switch and, therefore, indicates the height of the water level at 48. It is obvious, of course, that the position of any other indicator, meter, or register, may be transmitted by the same means.

When the wiper 32 reaches its thirteenth or last contact (although contact banks having more than thirteen contacts may be used), an obvious energizing circuit is completed for the relay 25. The relay 25 thereupon closes its contacts to complete its own locking circuit through its contact 52 and the back contact 29 of the relay 27, and to set up a circuit from the eleventh contact associated with the wiper 32 through the front contact 53 of the relay 25 to the winding of the relay 27. This circuit is not completed, however, until wiper 32 engages its eleventh contact in its second revolution. At contact 24, of relay 25 the original energizing circuit for the relay 22 is interrupted but this relay remains locked in through its contact 28 and contact 29 of the relay 27.

As the wiper 31 engages its twelfth and thirteenth contacts, the energizing circuit for the relay 45 is shunted and the contacts of said relay are released to restore the buzzer circuit to normal and re-establish the original energizing circuit for the stepping magnet 30. The selector switch 35 is again stepped from point to point to repeat the indication of the position of the float switch 49 in the same manner as that described heretofore.

When the selector switch has produced the code of sound impulses a second time and the spinning circuit therefor has again been completed, its wipers will be rapidly stepped past the contacts in the latter portion of its path of travel. When the wiper 32, in its second revolution, engages its eleventh contact, the circuit that was prepared by the energization of the relay 25 at its contact 53 for the relay 27 is completed. The operation of relay 27 closes locking circuit for itself at its contact 54 through the wiper 33 which moves from contact to contact with sufficient rapidity to prevent deenergization of the relay. At armature 29, the locking circuits of relays 22 and 25 are interrupted and these relays deenergized. The relay 27 causes positive battery current to be supplied through contact 29, wiper 34 and its eleventh contact, to the winding of relay 18.

The deenergization of relay 22 interrupts

the original energizing circuit for the stepping magnet 30 at contact 36, but a parallel circuit from positive battery terminal through the wiper 33 and armature 37 of relay 38 continues the stepping operation until the selector switch returns to normal, when further stepping is precluded since the first contact of wiper 33 is not connected to battery.

The energization of the relay 18 deenergizes relay 17a by opening its locking circuit at contact 19, and the subsequent deenergization of relay 17a restores the locking circuit for the relay 18 at its contact 17. The relay 21, solenoid 16, and all the remaining relays, with the exception of the relay 18, are deenergized and the system is returned to its normal, idle condition.

The circuit controlled by the contacts 17' and 18' of the relays 17 and 18, respectively, serves to prevent false operation of the system in case of battery failure.

Although the drawing includes a plurality of conventional representations of the substation battery, this expedient was adopted merely to obviate complication of the drawing by extending all circuits to a common battery, such as will be generally employed in an actual embodiment of our invention.

It will be apparent from the foregoing description that the system of our invention accomplishes the automatic transmission of an indication from a distant, unattended station, to a central office, as the result of a telephone call made, in the usual manner, through the existing telephone system.

Numerous applications for the system shown and described will, no doubt, occur to those skilled in the art, as well as changes in the details of the disclosure. It is not our intention, therefore, to be limited to the exact embodiment of the invention as described and claimed, except as indicated by the appended claims.

We claim as our invention:

1. In a signalling system, the combination with a dispatcher's office and a remote station, telephones at said office and station adapted to be connected through a public telephone system, of a solenoid at said station for lifting the telephone receiver thereat, a relay controlled by the telephone ringer for energizing said solenoid, a measuring device at said station, and means including a selector switch responsive to the operation of said relay for producing a number of sounds at the transmitter of the substation telephone determined by the condition of said measuring device, and means for causing the sound-producing means to repeat said sounds and subsequently deenergize said solenoid.

2. A signalling system comprising a sta-

tion having a telephone therein connectible through the usual system to any other telephone in the system, means responsive to the ringing operation of the station telephone for lifting the telephone receiver, a metering device at the station, and means for producing sounds at the transmitter of the station telephone in accordance with the indication of said metering device and means for initiating the operation of said sound-producing means in response to the ringing operation.

3. A metering system comprising a station, a metering device and a telephone at the station, said telephone being connected to a public telephone system, means responsive to the signal calling for the telephone for lifting the receiver, and means further responsive to the calling signal for producing, at the transmitter of the telephone, a sound code indicative of the position of the metering device, thereby to cause the transmission of a sound code over the telephone system to a distant calling party.

4. In a signalling system, the combination with a first station and a second station, telephones in each station connected by a telephone system, of a solenoid for lifting the telephone receiver at the second station, an indicating device, means at the second station for producing sound codes at the transmitter of the telephone in accordance with the position of the indicating device, and means responsive to the operation of the ringing device of the telephone at the second station for simultaneously instituting the operation of the receiver-lifting device and the sound-code-producing means to effect the transmission of a sound code over the telephone system to the first station.

5. In a signalling system, the combination with a first station and a second station, telephones in each station connected by a telephone system, of a solenoid for lifting the telephone receiver at the second station, an indicating device, means at the second station for producing sound codes at the transmitter of the telephone in accordance with the position of the indicating device, means responsive to the operation of the ringing device of the telephone at the second station for simultaneously instituting the operation of the receiver-lifting device and the sound-code-producing means, and means for causing said sound-code-producing means to transmit two complete sound codes over the telephone system to the first station and subsequently deenergize the receiver-lifting solenoid.

6. In a signalling system, the combination with a dispatcher's office and a substation, telephones at said office and substation adapted to be connected through a public telephone system, of means responsive to the ringing of the substation telephone for

lifting its receiver, a measuring device, means for producing sound codes at the substation telephone transmitter, a selector switch for controlling the operation of said sound-producing means, said selector switch being set in operation in response to the ringing of the substation telephone bell to cause the sound-producing means to produce a sound code in accordance with the position of the metering device, and means for causing the selector switch to effect the production of the sound code a predetermined number of times and subsequently restore the system to normal.

7. In a signalling system, the combination with a dispatcher's office and a substation, telephones at said office and station adapted to be connected through a public telephone system, of a solenoid for lifting the receiver of the substation telephone, a measuring device, a loud-speaker positioned in front of the telephone transmitter, a buzzer device for operating the loud-speaker, a distributor associated with the measuring device for controlling the operation of the buzzer device, means responsive to the ringing of the substation telephone bell for initiating the operation of the distributor and effecting the energization of the receiver-lifting solenoid, said distributor being disposed to automatically effect a predetermined number of buzzer operations in accordance with the position of the measuring device to transmit a sound code over the telephone system to the dispatcher's office, and means for stopping the distributor after two complete sound codes have been transmitted.

In testimony whereof, we have hereunto subscribed our names this 9th day of March, 1929.

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GENNERO DE CROCE.