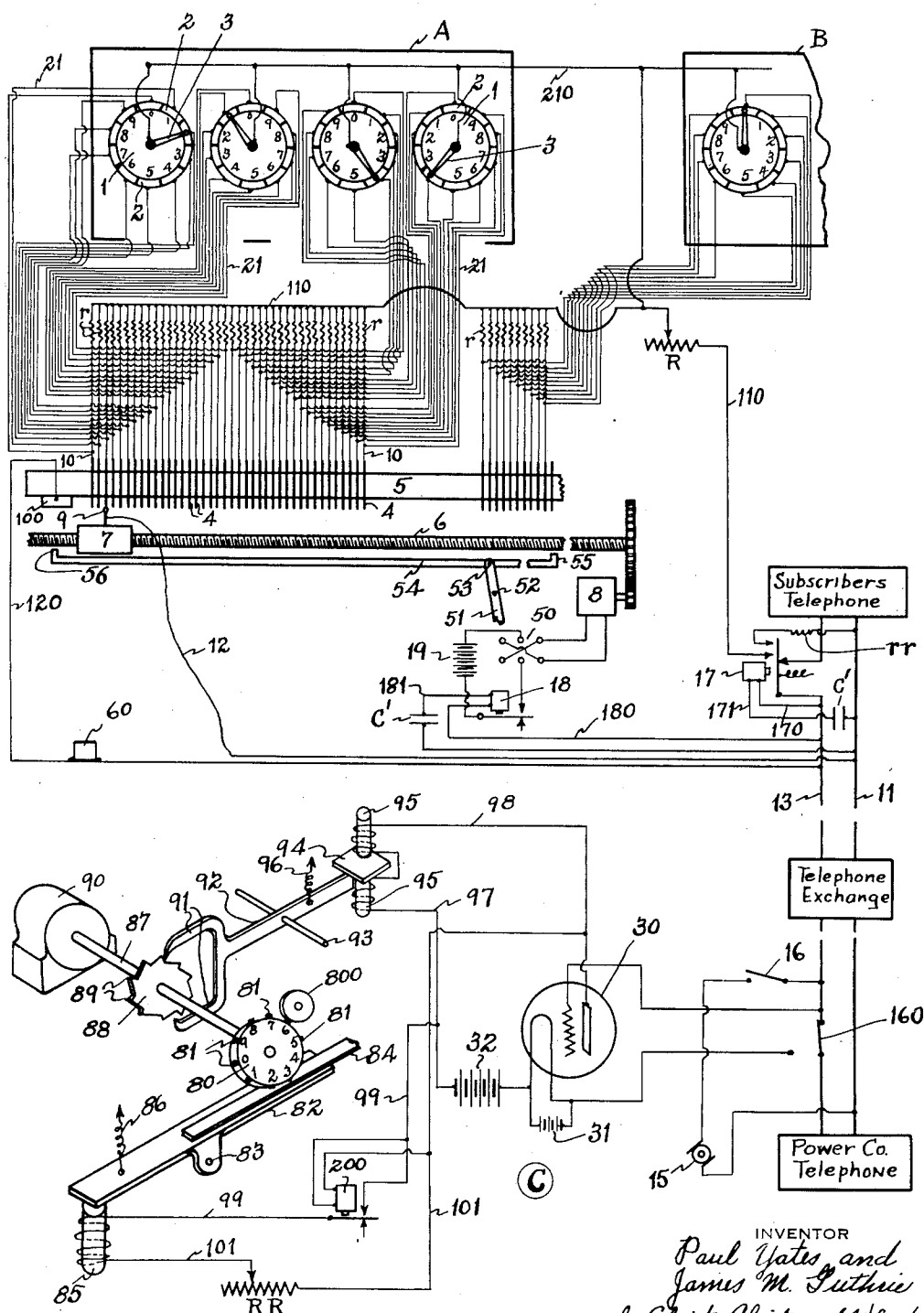


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METER READING APPARATUS

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METER READING APPARATUS

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The invention relates to the mechanical reading of meters, and this specification comprises a continuation in part of application Serial No. 530,781, filed April 17, 1931.

5 The object of the invention is to provide instrumentalities which are particularly effective in determining a record of the reading of an electric, gas, or water meter over an electrical communication system, such, for example, as the
10 Bell Telephone System.

Another object of the invention is to provide means which may be organized with a subscriber's meter and with an electrical circuit, and which may be controlled by an attendant at a
15 remote place (such as a power company's office) to effect the operation of a device for the recording of the reading of such meter. Simplicity in the structure of the apparatus, economy in its installation and use, and certainty of operation,
20 are other objects in mind.

The accompanying drawing is a diagrammatic view of a telephone system, showing the apparatus of the present invention associated therewith.

25 We have illustrated a meter A, having four dial faces 1, each of which is provided with an index 3. Coordinated with each of the graduations of the faces 1 is a contact member 2 of electrical conductive material, the several
30 contact members 2 being insulated one from the other. On a support 5 of electrical insulating material is a plurality of contacts 4, there being one contact 4 for each of the reading positions of the meter indices 3, that is, for each of the
35 contact members 2. Each contact 4 is connected by a wire 10 to a bus line 110, and each line 10 includes a resistance *r*. By means of wires 21 the contact members 2 are connected in sequence to the wires 10, and, as illustrated, such connections to the wires 10 are made between the
40 contacts 4 and the resistances *r*. A wire 210 electrically unites the indices 3 with the bus 110, between the connections of the wires 10 to the bus and a relay 17 with which the bus 110 is
45 united.

A telephone system is diagrammatically indicated by three rectangles (each of which includes a self-describing legend) and the lines 11 and 13. Electrical communication may be es-
50 tablished from the power company's telephone in their office C, through the usual telephone exchange, to the subscriber's telephone, which is, of course, situated some distance from the power company's office. The desideratum is to obtain
55 automatically in the office C a record of the posi-

tion or reading of the remotely located indices 3.

Upon a threaded shaft 6 is a carriage 7; a motor 8 is geared to effect the rotation of shaft 6, and according as the shaft rotates, the carriage 7 travels thereon. A brush 9 is borne by the carriage 7, and, as the carriage travels, the brush 9 progressively makes and breaks contact with the several contacts 4. As presently will appear, the relay 17 is adapted to open the telephone circuit at the subscriber's end, and to connect the bus wire 110 with one wire (13) of the telephone system. A lead wire 12 connects the brush 9 with the other wire (11) of the telephone line, and, during the travel of the carriage, the brush 9 will close and open an electrical circuit across the telephone wires 11 and 13 each time that it passes over a contact 4. Assuming the telephone circuit to be otherwise complete, each of such make and break engagements between the brush 9 and contacts 4 will create an electrical impulse in the telephone circuit, and it is a plurality of these impulses which we employ to operate recording apparatus in the power company's office C.

The recording apparatus comprises a printing wheel 80 which has on its peripheral face a character 81 for each of the several positions which the indices 3 may take. The characters may be numbers corresponding to the numerals on the dial faces 1, or they may each be in form a duplication of the dial faces 1. For example, the character 81 which is adjacent the figure 0 on the side face of wheel 80 may be such that it is capable of printing a reproduction of a dial face 1 with its index 3 pointing to zero. The character next in sequence on the wheel 80 (the character adjacent the figure 1 on the wheel) may be such as to permit a reproduction of a dial face 1 with the index 3 pointing to the numeral one. And so the wheel 80 may be provided with characters which, upon the rotation of the wheel to an appropriate position with respect to other instrumentalities, will effect in the power company's office a replica of the remotely located dial faces 1 and their indices 3.

Conveniently, a platen 82 is pivotally secured at 83 to a suitable support or frame (not shown), and a paper 84 is positioned on the platen and at an interval of space from the periphery off the printing wheel 80. An electromagnet 85, when energized, is adapted to attract the left-hand end of the platen downward, against the resistance of a spring 86, thereby moving the paper 84 against that character 81 which has been shifted by the rotation of the printing wheel to the proper position for recording the reading of one of

the indices 3. Conveniently, an inking wheel 80 moistens the characters 81, preparatory to printing. A paper-feeding device may be associated with the platen 82, to shift the paper 84 automatically for the reception of a succession of dial readings, but with such detailed structure we are not immediately concerned and, therefore, have not illustrated it.

The wheel 80 is secured to a shaft 87; on this shaft there is fixed a ratchet wheel 88 having ratchet teeth 89 corresponding in relative position and in number to the characters 81 on the printing wheel 80. A spring or other suitable means is housed in a case 90; the spring is so connected to the shaft 87, and is so energized as to tend constantly to rotate the shaft clockwise. Such rotation, however, is constrained; it is controlled by a compound pawl 91, which pawl constitutes one terminal of an arm 92. The arm 92 is pivotally mounted for oscillation about a fixed axis 93, and, upon one oscillation of the pawl, the ratchet wheel 88 is released to advance clockwise from one tooth to the next. An armature 94 of magnetic characteristics is secured to the right-hand end of the arm 92, and an electromagnet 95 when energized is adapted to effect a slight clockwise movement of the arm 92, while immediately thereafter a spring 96 causes a short counter-clockwise movement of the pawl arm. So it will be understood that an electrical impulse may be adapted to energize the magnet 95, to cause an oscillation of the ratchet arm 92, and to effect the rotation of the wheel 80 through such an arc that the character 81 which is in printing position will be moved out of such position and the next succeeding character 81 on the periphery of the printing wheel will be moved into position for printing.

Conductors 97 and 98 afford electrical connection of the magnet 95 to the telephone system (at the power company's office), and the wires 99 and 101 are connected to bring the magnet 85 under the electrical influences of the system. An alternator 15 is provided, and under the control of a switch 16 is adapted to be closed across the telephone lines. At the subscriber's end of the telephone line, the two relays 17 and 18 each have one of their terminals connected by a conductor (170 and 180 respectively) to the line 13 of the telephone system. The other terminals of the relays 17 and 18 are respectively connected by wires 171 and 181 to the telephone wire 11. Conveniently, a suitable condenser C' is included in each of the conductors 171 and 181, so as to prevent a closed shunting of the relays across the telephone wires. These relays and condensers are such in structure as to be sensitive to the electrical effect of the alternator, and not to be influenced by the normal operating currents and electrical impulses of the telephone circuit. To obtain a reading the attendant, having secured connection through the telephone exchange with the subscriber's telephone, closes the switch 16, and shifts the switch 160 from its illustrated vertical position to a horizontal position. This shifting of switch 160 brings the circuits 97, 98 and 99, 101 under the influence of the telephone system. The closing of switch 16 effects the operation of the relay 17 to open the line 13, and to complete connections between the telephone wire 13 and the bus wire 110. Simultaneously, relay 18 functions to close connections from a suitable source (19) of energy to the motor 8. It should be mentioned that the alternator 15 is one of high frequency, the frequency and general character-

istics of the alternator being such as not to cause "cross-talking", or in any other objectionable manner to interfere with the normal operation of the telephone system.

The position of rest of the carriage 7, that is, the location of the carriage before the start of a reading is at the left-hand end of the shaft 6, where the brush 9 is in engagement with the contact 100 (which contact is later to be described). Also, at the start of the meter-reading operation the printing mechanism is in such position that a single oscillation of the pawl arm 92 will effect the turning of the wheel 80 to move that character 81 which indicates a "zero" reading into printing or recording position. When the switches 16 and 160 are closed, as said, the relay 17 is caused to unite electrically the bus 110 with the line 13, and the relay 18 closes connections to the battery 19 for the energization of the motor 8. The motor rotates; the carriage 7 travels from left to right on the shaft 6; and the brush 9 successively engages the contacts 4. Each time that the brush 9 strikes a contact 4 a circuit will be closed across and an impulse created in the telephone lines 11 and 13. Indeed, the effect of the brush 9, in sweeping over the contacts 4, is substantially similar to that occasioned by raising and lowering the receiver hook of one of the telephones in the system, when such system is connected for normal service. The impulses tend to interrupt the telephone connections established by the exchange, and a feature of our invention is found in means to prevent such interruption. Advantageously, such means comprise a resistance *rr* which is shunted across the telephone lines when relay 17 is shifted to effect a meter reading operation.

As above mentioned the sweep of the brush 9 effects the making and breaking of a circuit (or circuits) in the telephone system, and, no additional power being added to the telephone lines, as is desired to be the case, the making and breaking of the circuit, or circuits, sets up electrical impulses in the telephone lines. Inasmuch as these impulses are similar to those effected by jiggling the receiver hook of either telephone, it will be understood that no electrical conditions foreign to those for which the telephone system was designed will be produced. This is of great practical importance.

If these so-called natural impulses, which are thus created in the telephone system, are too weak to operate the printing mechanism, we contemplate employing a current amplifier in the power company's office C. By way of example we show an amplifying tube 30 connected in usual manner to a low voltage source of energy 31 and a high voltage source 32, whereby the impulses created in the telephone system will be magnified to necessary degree in the lines 97, 98, 99, 101.

In the drawings it will be observed that each circuit which the brush 9 closes, to create an impulse, comprises a contact 4, its associated lead wire 10 and resistance *r*, the bus 110, the telephone wire 13, connection to amplifier 30, the wire 98, the electromagnet 95, the wire 97, the wire 11 of the telephone lines, and the conductor 12 from the wire 11 to the brush 9. Upon the closing of each of these circuits through the contacts 4, as above mentioned, an electrical impulse is created, and this impulse effects the oscillation of the pawl arm 92, and rotates the wheel 80 through an interval from one printing character (81) to the next. That is to say, when the brush 9 strikes the first contact 4 in its left-

to-right travel, the consequent impulse effects the movement of the wheel 80 to shift out of printing position that character 81 which corresponds to a meter reading of "nine", and to place into printing position that character which corresponds to a meter reading of "zero". And, upon a succession of impulses, the wheel 80 in this manner intermittently moves its characters, one after another into printing position.

It will be understood, therefore, that in coordinating, as we do, the contacts 4 with the numerals (or dial positions) of the dial faces 1, we cause the printing wheel 80 to move successively through printing positions which are in correspondence with the successive indicating positions which the indices 3 may take on the faces 1. It will also be understood that, as the wheel 80 brings its characters 81, one after another, into printing position, no printing is done, save when the brush 9 strikes those contacts 4 which correspond to the indicating positions of the indices 3, and, accordingly, the paper 84 will show only the instantaneous readings of the dials 3 each time that the brush 9 moves across all of the contacts 4. This means that the platen 82 must remain inactive to all except (assuming that the four-dialed meter A is the only meter connected) four of the impulses which are created by the actuation of brush 9, and to this end we provide means to distinguish these particular impulses. Advantageously such means may be resistances, indeed, we include in each of the contact leads 10 a resistance r , and provide for each index position a line 21, which, with the associated index 3 and line 210, is capable of shunting or shorting the resistances r . Of all the resistances r shown, only the four associated with those particular contacts 4, which correspond to the positions of indices 3, are shorted or shunted; that is, for the positions of the indices 3 in the drawing, only the resistances r , which are associated with the 3rd, 12th, 25th, and 35th (counting from left to right) contacts 4, are shunted. The indices 3 complete or close the shunting circuits. Accordingly, in moving from left to right, the brush 9 causes an impulse each time that it strikes a contact 4. Each of such impulses is opposed or limited in magnitude by a resistance r , except those impulses which are created in the four instances referred to. These four exceptional impulses (because of decreased line resistance) are of greater magnitude than the others, and are adapted to effect the operation of the printing platen 82.

All impulses created upon the actuation of the brush 9 are each sufficient to cause an oscillation of the pawl arm 92, but only the four distinct impulses are effective upon the magnet 85, to cause the platen 82 to operate. A resistance R_R and a relay 200 are included in the lines 99 and 101, and, until a resistance r in the lines 10 is shunted, the impulses set up in the system are insufficient to energize the relay 200 to such a degree that it will close circuit 99, 101, to effect movement of the platen 82 into printing position. So, it will be understood that when the brush 9 strikes a third contact 4, a distinct impulse is produced. This distinct impulse oscillates the arm 92, causing the character 81 which corresponds to a dial reading of "two" to move into printing position, and also sufficiently energizes the relay 200, to cause it to close and to effect operation of the printing platen 82. The reading of the left-hand index 3 is thus recorded. The relay 200 serves to retard the operation of

platen 82 until the wheel 80 has assumed the desired printing position.

The brush 9 continues on its way to the right, successively engaging the remaining contacts 4. Accordingly, the wheel 80 is shifted from one printing position to another, and when the tenth contact 4 (the tenth counting from left to right) is engaged, the wheel 80 will be found to lie in starting position again, that is, in such position that one impulse will move it into position to print a "zero" reading. So, continued movement of the brush 9 will in the manner already described effect the recording of the second dial, and of the third, and the fourth dials. When the last contact 4 (the one to the right to which the numeral 4 is immediately applied) is reached, the wheel 80 will rest in starting position once again. Such is the organization and synchronization of the parts.

When the attendant sees that four dials have been recorded and the wheel 80 has returned to starting position, he swings the switch 160 back to its vertical position. This cuts the recording instrumentalities from the circuit. The carriage continues travelling to the right until it operates a reversing switch 50, to effect the reverse rotation of the motor 8 and the return of the carriage to its starting position at the left-hand end of the shaft 6. The reversing switch may be in structure a well-known "star" switch, and conveniently a lever 51 is pivotally secured at 52 to a fixed support (not shown). The lower end of this lever is secured in a suitable manner to the throwing arm of such reversing switch, while the upper end of the lever is pivotally connected at 53 to a trip-rod 54. The carriage 7 strikes a protuberance 55 on the trip-rod, and effects the clockwise shifting of the lever 51, to spring the switch 50 to its alternate position. Then, the motor is reversed and the carriage returns to starting position. Inasmuch as the connections to the recording instrumentalities are broken by the switch 160, the wiping of the brush 9 on the contacts 4 does not disturb the printing wheel 80.

Means are provided to notify the meter reader in the office C when the carriage has reached starting position. Such means include a buzzer (or automatic make-and-break device) 60 which is connected, by a wire 120, to the contact piece 100 and the wire 13 of the telephone system. When the carriage approaches its starting position, the brush 9 makes contact with the piece 100, and completes a circuit through the buzzer 60 to the telephone lines 11 and 13. In the office C, the attendant either by means of head phones or a loud speaker suitably connected to the telephone line, hears the buzzer speak and knows that the carriage has reached, or practically has reached, its starting position. The attendant then opens the switch 16 which causes the relays 17 and 18 to return to their illustrated positions, and thus restores the telephone circuit to condition for normal service.

There is a protuberance 56 on the left-hand end of the trip-rod 54, and if the key 16 is opened before the carriage 7 (during its return movement) strikes the protuberance 56, the carriage ceases to move, but it will continue its right-to-left (return) movement when the switch or key 16 is at some later period depressed to take a reading. That is to say, the carriage will always move to the left until the protuberance 56 is struck, to trip the rod 54 and shift the lever 51, so that the reversing switch 50 is thrown into such position that the motor 8 is caused to effect the move-

ment of the carriage in a left-to-right direction, as first explained.

Thus it will be seen that one person may obtain a record of the instantaneous reading of a meter which is located at a remote point. To make adjustment for the resistances and impedances, etc. of the telephone system, each meter reading device is (when first installed) balanced in an electrical sense with the recording instrumentalities in the home office C. A variable resistance R in the bus line 110 is convenient to this end.

It will be obvious that the dials of several meters, say a water meter, gas meter and electric meter (cf. fragmentarily indicated meter B), can be all organized with auxiliary circuits 21 and connected in appropriate succession to contacts 4, whereby a single installation may obtain record of the dials of all meters in a subscriber's home.

In the following claims we describe the auxiliary circuits (21) in combination with the dial faces. It should be understood that such wording is purely for simplicity of expression. That is to say, dial faces per se need not be included in the meter, since a visual reading of the meter need not be made. The fact is that the contact members 2 can be arranged to be engaged successively by other elements of the meter which move in accordance with the measuring operation of such meter.

We claim as our invention:

1. In combination with a meter having instrumentalities movable through metering cycles, an electrical communication system, electrical circuits associated with said meter instrumentalities for connection to said communication system, means associated with said circuits for creating electrical impulses in said system, certain of said impulses being distinct from others, and recording apparatus electrically connected to said communication system, which recording apparatus includes type, together with means for advancing the type upon each impulse created in such system, and means associated with said type, responding only to the certain distinct impulses created in the system, and co-operating with said type to produce a record of said meter.

2. In combination with a plurality of meter members movable through metering cycles, an electric conductor system, electric circuits associated with each of said meter members for connection to said system, means associated with said circuits for creating electric impulses in said system, certain of said impulses being distinct from others, and recording apparatus adapted to be electrically connected to said system, which recording apparatus includes a printing device, together with means for shifting the device upon each impulse created in such system, and means associated with said device, responding only to the certain distinct impulses created in the system, and co-operating with said printing device to produce a record of the positions of said meter members.

3. In combination with an electric conductor system, a meter having a movable member whose movement is proportional to the measurement which said meter effects, an electric circuit organized with each of several positions through which said movable member advances, means for electrically connecting said circuits to said system, means organized with said circuits for creating a series of electric impulses in said system, and means cooperating with said movable member for electrically distinguishing one impulse of

the series from the others, and means adapted to be electrically connected to said system, and, when so connected, responding to said series of impulses, including the distinguished impulse, for indicating the metering position of said movable member.

4. In combination with an electric conductor system, a meter having a movable member whose movement is proportional to the measurement which said meter effects, an electric circuit organized with each of several positions through which said movable member advances, means for electrically connecting said circuits to said system, means organized with said circuits for creating a series of electric impulses in said system, and means cooperating with said movable member for electrically distinguishing one impulse of the series from the others, recording means, means for rendering said recording means responsive to electric conditions in said system, whereby in response to said series of impulses said recording means are adjusted in a position correlated to the instantaneous position of said movable meter member, and means included with said recording means and responsive to said distinguished impulse for making record of such instantaneous position of the movable meter member.

5. In combination with an electric conductor system, a meter having a movable member whose movement is proportional to the measurement which said meter effects, a normally-open electric circuit organized with each of the several positions through which said movable meter member advances, means for electrically connecting said circuits to said system, means organized with said circuits for normally closing them and creating a series of electric impulses in said system, and means cooperating with said movable member for electrically distinguishing one impulse of the series from the others, recording apparatus including printing means, means for rendering such apparatus responsive to the series of impulses created in said system, whereby the apparatus is shifted into position of correspondence with the position of said meter member, and means in such recording apparatus responsive to said distinguished impulse for producing a record of such position.

6. In combination, an electric conductor system, a meter including a member movable through successive positions in a metering cycle, means for creating in said system, regardless of which of the several metering positions said meter occupies at the time, an electric impulse for each of said positions through which said meter member moves, means cooperating with said movable meter member for rendering one of said impulses distinct from the others, and recording apparatus responsive to the impulses created in said system, whereby such apparatus is adjusted in accordance with the position of said meter member, and means organized with said apparatus and being responsive to the distinct impulse created in said system for producing a record.

7. The structure of the next preceding claim, in which said recording apparatus includes means for producing its advance through a cycle corresponding to the cycle through which said meter member moves, whereby said recording apparatus, being initially in inactive position, advances through its cycle and is restored to its inactive position in consequence of said impulses, and during the advance responds to the distinct impulse in the manner explained.

8. In combination with a meter having instrumentalities movable through metering cycles, an electrical communication system, electrical circuits associated with said instrumentalities for connection to said communication system, means associated with said circuits for creating electrical impulses in said system, certain of said impulses being distinct from others, and recording apparatus electrically connected to said communication system, which recording apparatus includes type, together with means for advancing the type upon each impulse created in such system, means associated with said type and responsive to said distinct impulses for producing a record of said meter, and means associated with said communication system for controlling at a remote point the electrical circuits and their associated means for producing impulses in said system.

9. In combination with a meter having a metering member movable from one metering position to another, a telephone system including office and subscriber's telephone lines adapted to be interconnected through a telephone exchange, an electric circuit associated with each metering position of said member and adapted to be connected with said subscriber's telephone lines, an electrical resistance embodied in each of said circuits, a movable contact for successively altering the electrical condition of said circuits and creating impulses in said telephone system, means associated with said metering member for shunting out the resistance of that particular circuit which is associated with the particular metering position which the metering member at a particular moment occupies, whereby, of the several impulses created in said telephone system, at least one will be distinguished, electrically controlled printing apparatus and means for connecting it to said office telephone lines, said printing apparatus comprising recording means correlated with the several metering positions which said metering member is adapted to take, said recording means being adapted to advance step by step as said impulses are created in said system, whereby the recording means is brought to a position corresponding to the instantaneous position of said metering member, together with means responsive thereafter to the distinguished electrical impulse for producing a record of the meter.

10. In combination with a meter having a metering member movable from one metering position to another, a telephone system including office and subscriber's telephone lines adapted to be interconnected through a telephone exchange, an electric circuit associated with each metering position of said member and adapted to be connected with said subscriber's telephone lines, an electrical resistance embodied in each of said circuits, a movable contact for successively altering the electrical condition of said circuits and creating impulses in said telephone system, means associated with said metering member for shunting out the resistance of that particular circuit which is associated with the particular metering position which the metering member at a particular moment occupies, whereby, of the several impulses created in said telephone system, at least one will be distinguished, electrically controlled printing apparatus and means for connecting it to said office telephone lines, said printing apparatus comprising recording means correlated with the several metering positions which said metering member is adapted to

take, said recording means being adapted to advance step by step as said impulses are created in said system, whereby the recording means is brought to a position corresponding to the instantaneous position of said metering member, together with means responsive thereafter to the distinguished electrical impulse for producing a record of the meter, and means associated with said telephone system for controlling the operation of said movable contact.

11. In combination with a meter having a metering member movable from one metering position to another, a telephone system including office and subscriber's telephone lines adapted to be interconnected through a telephone exchange, an electric circuit associated with each metering position of said member and adapted to be connected with said subscriber's telephone lines, an electrical resistance embodied in each of said circuits, a movable contact for successively altering the electrical condition of said circuits and creating impulses in said telephone system, means associated with said metering member for shunting out the resistance of that particular circuit which is associated with the particular metering position which the metering member at a particular moment occupies, whereby, of the several impulses created in said telephone system, at least one will be distinguished, electrically controlled printing apparatus and means for connecting it to said office telephone lines, said printing apparatus comprising recording means correlated with the several metering positions which said metering member is adapted to take, said recording means being adapted to advance step by step as said impulses are created in said system, whereby the recording means is brought to a position corresponding to the instantaneous position of said metering member, together with means responsive thereafter to the distinguished electrical impulse for producing a record of the meter, and electrical means associated with said telephone system for maintaining the interconnection of the office and subscriber's telephone lines through the exchange while said impulses are being created in said system.

12. In combination with a meter having a metering member movable from one metering position to another, a telephone system including office and subscriber's telephone lines adapted to be interconnected through a telephone exchange, an electric circuit associated with each metering position of said member and adapted to be connected with said subscriber's telephone lines, an electrical resistance embodied in each of said circuits, a movable contact for successively altering the electrical condition of said circuits and creating impulses in said telephone system, means associated with said metering member for shunting out the resistance of that particular circuit which is associated with the particular metering position which the metering member at a particular moment occupies, whereby, of the several impulses created in said telephone system, at least one will be distinguished, electrically controlled printing apparatus and means for connecting it to said office telephone lines, said printing apparatus comprising recording means correlated with the several metering positions which said metering member is adapted to take, said recording means being adapted to advance step by step as said impulses are created in said system, whereby the recording means is

- brought to a position corresponding to the instantaneous position of said metering member, together with means responsive thereafter to the distinguished electrical impulse for producing a
 5 record of the meter, and electrical means associated with said telephone system for maintaining the interconnection of the office and subscriber's telephone lines through the exchange while said impulses are being created in said system, and means associated with the telephone
 10 system for controlling, at a point remote from said meter, the operation of said movable contact.
13. In a telephone system including a telephone
 15 exchange, telephone lines running from a meter-reading office to said exchange, and telephone lines running from said exchange to a subscriber's telephone and adapted to be electrically coupled in said exchange with the telephone lines
 20 of said office; the combination of recording apparatus adapted to be operated by electric impulses, means for electrically connecting said recording apparatus to said telephone system, a meter, impulse-producing mechanism organized
 25 with said meter, means for electrically connecting said impulse-producing means to said subscriber's telephone lines, shunting means adapted to be electrically connected to said subscriber's telephone lines to maintain the office and subscriber's
 30 lines coupled through said exchange while said impulse-producing mechanism is creating electric impulses in said system, and means organized with the office telephone lines, and being effective through said exchange, for effecting the
 35 connection of said shunting means to said subscriber's telephone lines.
14. In a telephone system including a telephone exchange, telephone lines running from a meter-reading office to said exchange, and telephone
 80 lines running from said exchange to a subscriber's telephone, and adapted to be electrically coupled in said exchange with the telephone lines of said meter-reading office; the combination of recording apparatus adapted to be operated by
 85 electric impulses, means for electrically connecting said recording apparatus to the telephone lines of said meter-reading office a meter, impulse-producing mechanism organized with said meter, means for actuating said impulse-producing
 90 means, means for electrically connecting said impulse-producing means to said subscriber's telephone lines, means for temporarily disconnecting said subscriber's telephone from said system, electric means adapted to be electrically connected to
 95 said subscriber's telephone lines to maintain the office and subscriber's telephone lines coupled through said exchange while the subscriber's telephone is temporarily disconnected from the system, and means organized with the telephone
 100 lines of said meter-reading office, and being effective through said exchange for controlling both the means for disconnecting the subscriber's telephone from the system and the electric means for maintaining the office and subscriber's lines
 105 coupled when said subscriber's telephone is disconnected and impulses are produced in said system.

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