No. 672,064. Patented Apr. 16, 1901.

N. H. HOLLAND.

TELEPHONE METERING SYSTEM.

(Application filed Nov. 27, 1899.)

(No Model.)

Fig. 1.

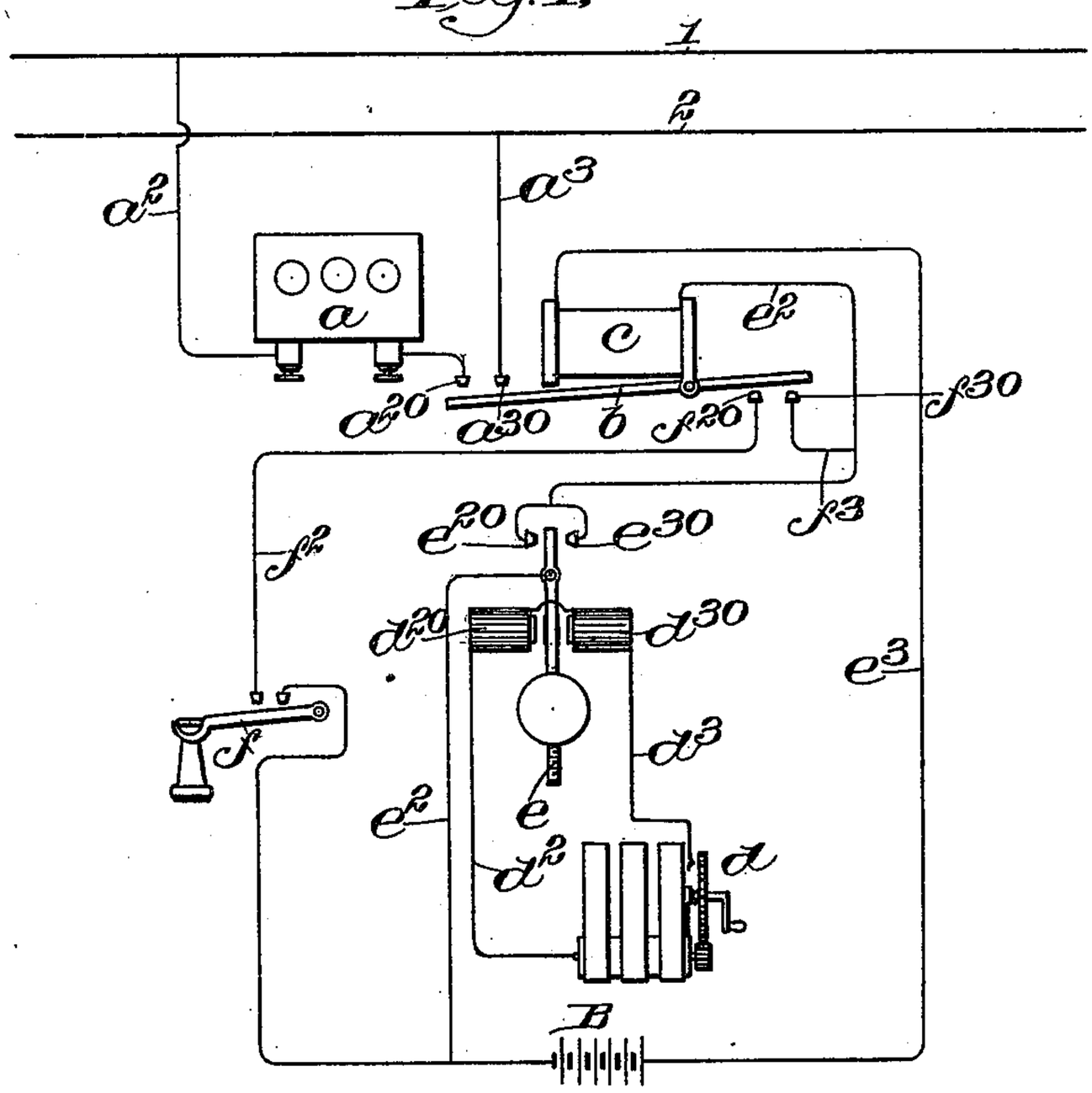
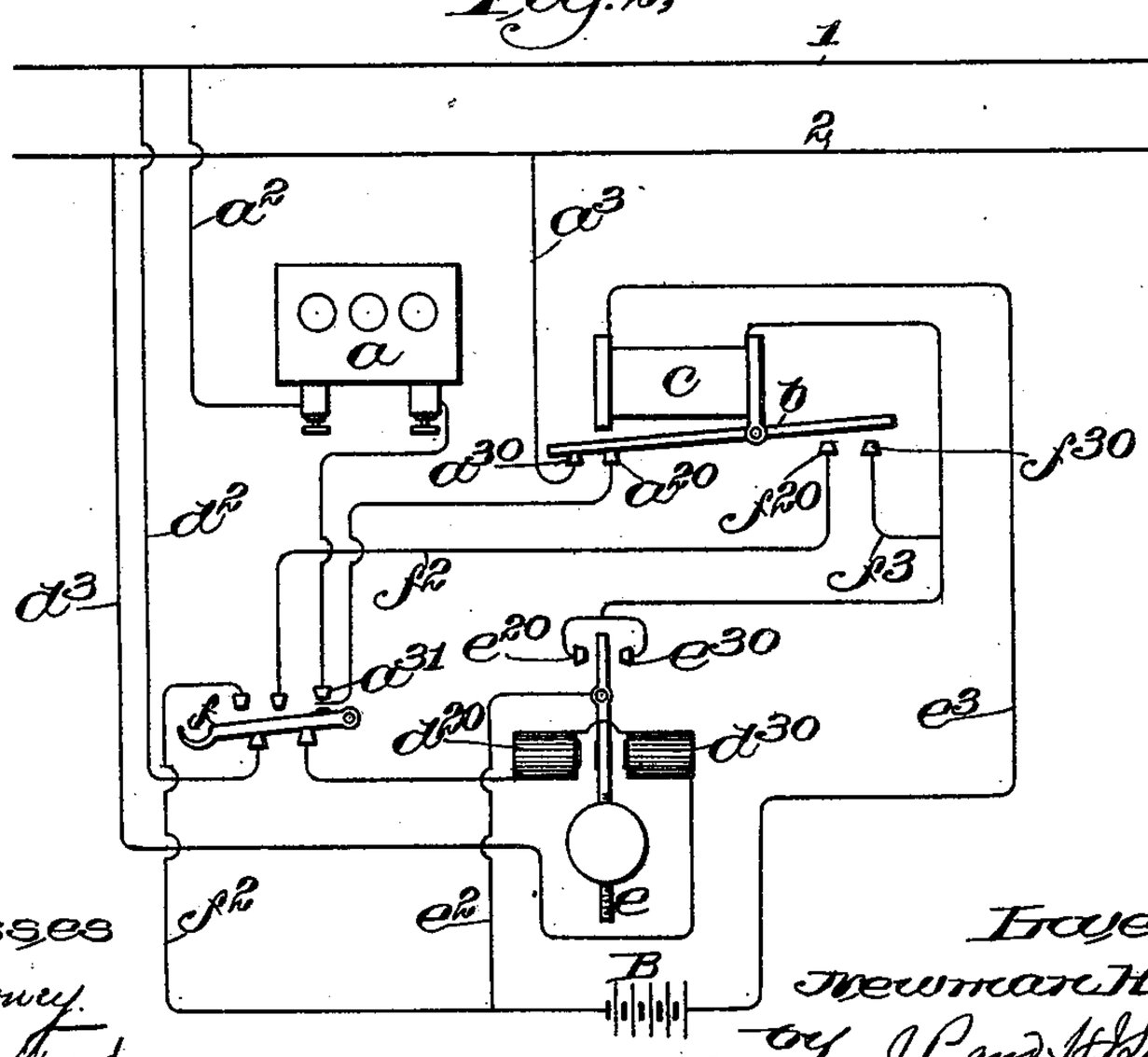


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE METERING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 672,064, dated April 16, 1901.

Application filed November 27, 1899. Serial No. 738,444. (No model.)

To all whom it may concern:

Be it known that I, NEWMAN H. HOLLAND, a subject of the Queen of Great Britain, residing in Brookline, county of Norfolk, and State of Massachusetts, have invented an Improvement in a Telephone Metering System, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

The present invention relates to a telephone metering system, and is embodied in controlling devices for the meter-circuit, the object of the invention being to primarily control the meter-operating circuit by means of the signaling device and to secondarily control said meter-operating circuit by means of the device which places the telephone in condition for conversation. The purpose of such consecutive operations is to cause the operation of the meter only at the instrument from which the call is originally sent and to prevent the operation of the meter at the receiving end of the line over which conversation is being carried on.

In accordance with the present invention each instrument is provided with a circuit-controller for the circuit which finally controls the meter, said circuit-controller being arranged to operate temporarily (whether its operation is intermittent or constant) in response to the operation of the signal-sending device, it being immaterial whether the said operation is caused mechanically or electrically, the device being illustrated, however, for convenience as operated electrically. The said circuit-controller is so arranged in accordance with the invention as to continue its operation for a predetermined period after the operation of the signal-sending device has ceased and to then cease its operation, the control of the meter-controlling circuit in the meantime being shifted to the devices operated by the telephone-receiver—as, for example, the gravity-hook. The device is so arranged, furthermore, that unless there is a preliminary closure of the meter-controlling circuit in response to the operation of the signal-sending device the said meter-controlling circuit will be beyond the control of the gravity-hook or its equivalent, so that when the receiver is removed at the receiving instrument or station which has been called the meter-circuit at that station will remain open and the meter inoperative.

It is immaterial whether the meter-controlling circuit is arranged to close the meter-operating circuit in response to the operations above described or to open said circuit, the object being merely to insure that the meter at the calling instrument only shall be in operative condition when connection has been made through the central office. When, for example, the telephones are provided with magneto call-bells, the meter-controlling circuits may be normally open and adapted to be closed in response to the consecutive operations of the signal-sending device and the device which places the telephone in condition for operation, the meter-controlling circuit at the called telephone remaining open, because the signal-sending device has not been operated; but when the telephones are installed in accordance with the so-called "central-energy system," in which no magnetos are used, the meter-controlling circuits may be normally closed and adapted to be opened in response to consecutive operations of the signal-sending device and the device which places the called-subscriber's telephone in condition for operation, the result being the same in this case, since the meter-controlling circuit at the calling-subscriber's telephone remains closed while that at the called-subscriber's telephone is opened, so that the meter at the calling-subscriber's telephone only is operative.

Figure 1 is a diagram showing the meter-circuit, the signal-sending instrument and its circuits, and the local-battery circuit as applied to a telephone having magneto call-bells or their equivalent, the other circuits being omitted, since they do not enter into the operation of the device, and may be arranged in any of the usual ways; and Fig. 2 is a similar diagram showing an embodiment of the invention as applied to telephones arranged in accordance with the central-energy system.

Referring to Fig. 1, the meter *a*, which may be of any suitable or usual type, is arranged to be operated by current in a circuit a^2 a^3, connected with the main-line circuit 1 2. The

meter is intended to be operated by a current of any suitable nature, which is included in the main circuit when connection is made at the central office, the construction and operation of the meter being immaterial so far as relates to the present invention, which is embodied only in the meter-controlling devices.

In the arrangement shown in Fig. 1 the meter-circuit is normally open, but adapted to be closed by a circuit-closer b, herein shown as comprising an arm arranged to be operated by an electromagnet c and so located as to bridge the terminals a^{20} and a^{30} when the said electromagnet is energized. The said electromagnet in accordance with the present invention is primarily energized in response to an operation of the signal-sending device d, which is herein shown as the ordinary magneto-generator, and the arrangement is such that upon the operation of the said generator to send a signal an energizing-circuit for said electromagnet c becomes closed temporarily, and subsequently becomes broken automatically, the parts being so arranged that a certain length of time intervenes between the end of the operation of the signal-sending device and the final continuous breaking of the meter-controlling circuit. This primary closure of the magnet-circuit may be performed by the operation of mechanical or electrical devices (the latter being herein shown) so arranged as to set in operation an "intermediate timing device," as it may be called, adapted to operate for a predetermined length of time after the initial impulse is finished and then to cease its operation, so that it has no further control over the magnet-circuit.

The connections between the magneto-generator and the line have been omitted from the accompanying drawings in order to avoid confusion in tracing the circuits. It is to be understood, of course, that the magneto-coils d^{30} are in series with the magneto-circuit, which is connected with the line in the usual way in order to send signaling impulses over the line.

As herein shown, the timing device may be a pendulum e, arranged to be set in motion by energizing magnet-coils d^{20} and d^{30}, included in a circuit $d^2\ d^3$ from the magneto d, the pendulum e constituting a polarized armature between the said magnet-coils, so as to be set in motion in response to the action of an alternating current passing through said coils. The movement of the said pendulum is arranged to control a circuit $e^2\ e^3$, in which is included the local battery B and the electromagnet c, so that upon the closure of said circuit the circuit-closing member b is attracted by the magnet and caused to close the circuit $a^2\ a^3$.

The devices might obviously be so arranged as to maintain the magnet continually energized for a predetermined length of time by providing the pendulum e or its equivalent with a retarding device to control the restoration thereof to its normal position; but, as herein shown, the swinging of the pendulum is arranged to accomplish the same result by alternately making and breaking the circuit $e^2\ e^3$ as long as the pendulum remains in motion, the pendulum being shown as connected with the conductor e^2 and alternately making contact with the terminals e^{20} and e^{30}. Thus even after the signal is sent in and the signal-sending device is no longer in operation the magnet c will continue for awhile to be energized at intervals, owing to the momentum of the pendulum e. As herein shown, the armature b is arranged to constitute the circuit-closer for the meter-circuit, since the meter-current is not usually present until two instruments are positively connected, so that the momentary closures will not cause the meter to operate.

To maintain the meter-circuit permanently closed during the operation of the telephone, it is necessary to provide the circuit-closer therefor with a secondary controlling device, the said secondary controlling device being operated in response to the removal of the receiver from the gravity-hook. As herein shown, the same operation which closes the circuit a^2 and a^3 in response to the operation of the device d simultaneously closes the circuit $f^2\ f^3$, also passing through the local battery B, the part f^3 being shown as a branch from the negative side of the circuit $e^2\ e^3$, hereinbefore described, the gravity-hook f being contained in said circuit, which is normally open, but closed when the receiver is taken down. As herein shown, the said circuit is provided with contact-pieces f^{20} and f^{30}, arranged to be bridged by a portion of the arm b, so that each time the magnet c is energized in response to the action of the device d the circuit $f^2\ f^3$ will also be closed. So long, however, as the receiver remains on the gravity-hook the closure of the circuit $f^2\ f^3$ at the contact-points f^{20} and f^{30} will be productive of no result, since the said circuit remains open at f. As soon, however, as the receiver is taken down, thus permanently closing the circuit at f, it is obvious that as soon as the contact-pieces f^{20} and f^{30} are connected the circuit $f^2\ f^3$ will be complete, so that the magnet c will be permanently energized during the time the receiver is removed.

In the operation of the device the pendulum e is set to vibrating when the magneto d is operated and will continue vibrating by momentum for a sufficient length of time after the operation of the magneto d to cover the interval which ordinarily elapses between the operation of the magneto and the removal of the receiver from the gravity-hook. The pendulum e, which is shown as forming part of the conductor e^2, comes in contact alternately with the terminals e^{20} and e^{30} and at each contact temporarily closes the circuit $e^2\ e^3$ through the magnet c. This produces a vibration of the arm b, momentarily closing the circuit $a^2\ a^3$ at intervals, there being, however, no permanent closure of the

said circuit until the receiver is removed from the gravity-hook. The removal of the receiver closes the circuit f^2 f^3 by the said gravity-hook, and the next movement of the arm b will close the circuit at f^{20} and f^{30}, thus producing a permanently-closed circuit through the local battery and magnet c, so that the arm b will be held in position to close the meter-circuit during the operation of the telephone. As soon as the conversation is finished and the receiver hung up, it is obvious that the circuit f^2 f^3 being broken the arm b will drop to its normal position, throwing the meter out of connection with the line. The circuit d^2 d^3 is intended to be closed only when the magneto is actually operated and not in response to a current received in the signal-bell magnets, so that at the telephone where the call is received there can be no operation of the meter, since there is no initial impulse or operation to produce the preliminary closure of the circuit through the magnet c.

In the so-called "central-energy system" the arrangement has to be somewhat modified, for the reason that the calling subscriber does not operate a magneto or equivalent device, a signal being sent to the central office in response to the operation of taking the receiver down from the gravity-hook. The signal-sending device in this case is wholly under the control of the operator at the central office, there being a source of alternating currents which is switched into the line to operate the called-subscriber's bell. In this instance, therefore, the meter-circuit must be controlled at the called-subscriber's telephone, and the parts are therefore so arranged that the successive operations of the signal-sending current and the device which places the telephone in condition for conversation cut out the meter at the called-subscriber's telephone, the meters being normally in circuit and the one at the calling-subscriber's telephone remaining in circuit, since it is not subjected to the action of the signal-sending current.

As indicated in Fig. 2, the meter-circuit a^2 a^3 is normally closed at a^{20} and a^{30}, but adapted to be broken and to remain broken when the magnet c is permanently energized. The circuits controlling the magnet c are arranged substantially as before, the circuit through the magnet-coils d^{20} d^{30} being normally closed by the gravity-hook when the receiver is hung up. Taking down the receiver, therefore, breaks the circuit through the said magnet-coils d^{20} d^{30}, thus placing the meter-controlling circuit beyond the control of the signal-sending current from the central office, it being obvious, therefore, that the magnet c cannot become energized and that the meter-circuit will remain closed. At the called-subscriber's circuit, on the contrary, the circuit through the coils d^{20} d^{30} is closed when a signal is received, (the gravity-hook being down,) and the signal-sending current will therefore start the timing device, as hereinbefore described, thus temporarily or intermittingly closing the circuit of the magnet c at the contacts e^{20} e^{30}. When the called subscriber takes down his receiver, he closes the circuit f^2 f^3, so that if the armature of the magnet c is in position to bridge the contacts f^{20} f^{30} the magnet-circuit will be closed, thus permanently cutting out the meter-circuit a^2 a^3. The result in this case is the same as before—namely, that the meter at the calling-subscriber's telephone is in operative condition while conversation is being carried on while the meter at the called-subscriber's telephone is inoperative, the controlling means operating as described in connection with the arrangement shown in Fig. 1 and the principle involved being the same. The meter-circuit may, if desired, be provided with an additional circuit-closer (indicated at a^{31}) under the control of the gravity-hook, so that when the telephone is not in operative condition the meter-circuit will be open, so as not to be accidentally operated should a meter-operating current be switched into the line. This circuit-closer, however, does not in any way affect the control of the meter which has been hereinbefore described.

It is not intended to limit the invention to the specific construction of the devices or arrangement of the circuits herein shown, since it is obvious that the initial circuit-controlling device may have many equivalents, both electrical and mechanical, while there may be modifications in the means for subsequently controlling the meter-circuit in response to such operation as places the telephone instrument in condition for conversation.

I claim—

1. In a telephone metering system, a signal-sending device; a timing device adapted to be set in operation thereby and to continue in operation a predetermined length of time after the initial impulse which has set it in operation; and a meter-controlling device operated jointly by said timing device and the device which places the telephone instrument in condition for use, as set forth.

2. In a telephone metering system, a controller for the meter-circuit, means for initially operating said controller in response to the operation of the signal-sending device, means for maintaining said controller in operation after the signal-sending device has ceased to operate; means for automatically restoring said controller to normal condition when said maintaining means have ceased to operate unless said controller is otherwise acted upon, and means for finally operating said controller in response to the operation of the devices which place the telephone in condition for use, as set forth.

3. In a telephone metering system, a meter; a device operated in response to the actuation of the signal-sending device and adapted to continue temporarily in operation after such actuation has ceased, said device being

adapted to place the meter in condition to operate when the telephone instrument is used, and independent means for retaining said meter in such condition, said means operating in response to the devices which place the telephone in condition for use provided the telephone is placed in such condition before the temporarily-operating device has ceased to act, as set forth.

4. In a telephone metering system, a meter-controlling circuit controlled by an electromagnet in the local-battery circuit, means for temporarily closing said local-battery circuit in response to the operation of the signal-sending device, and means for retaining said circuit closed during the use of the telephone, said means being inoperative unless the temporary closure has been effected.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

NEWMAN H. HOLLAND.

Witnesses:
HENRY J. LIVERMORE,
NANCY P. FORD.