G. DEAKIN.

TELEPHONE METER SYSTEM.

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990,638.

Patented Apr. 25, 1911.

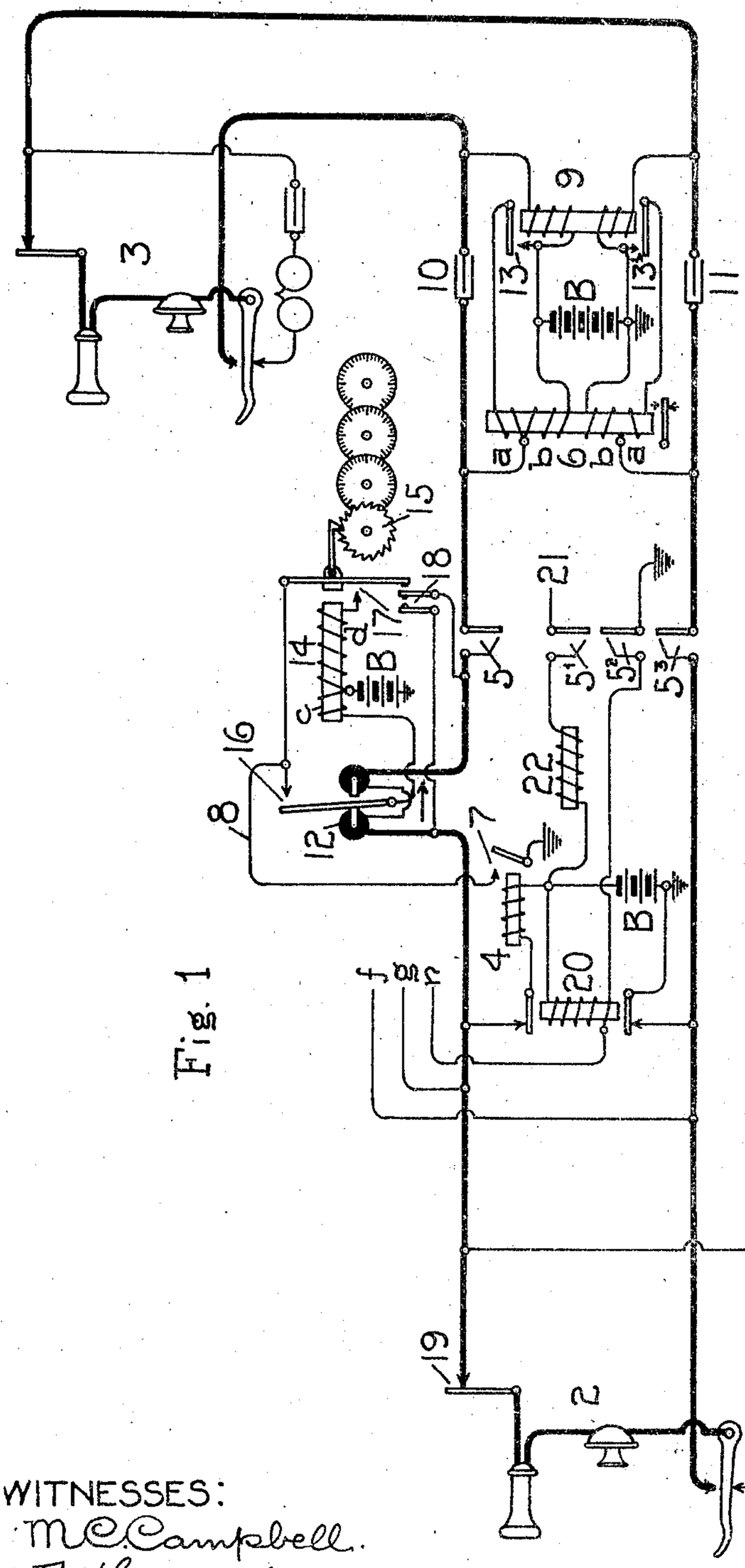

Fig. 1

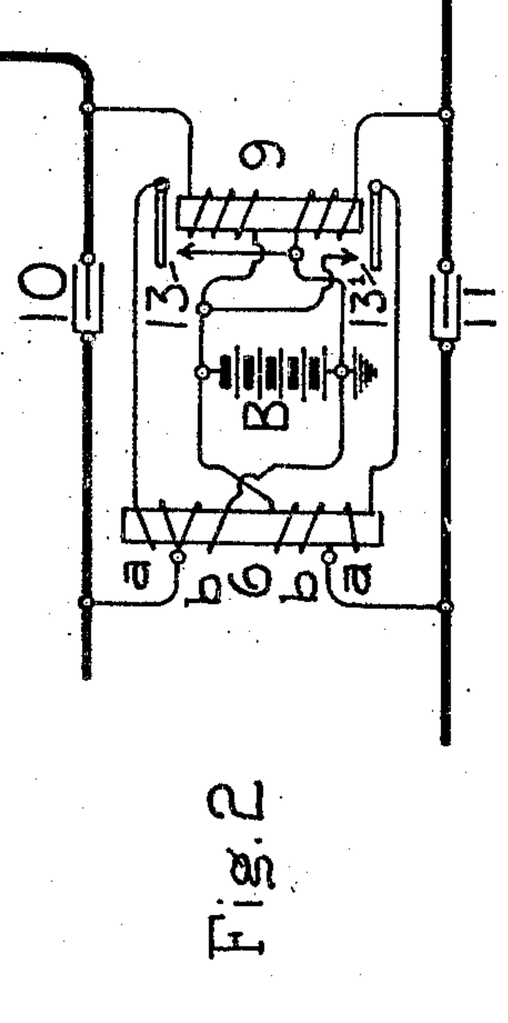

Fig. 2

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TELEPHONE METER SYSTEM.

990,638. Specification of Letters Patent. Patented Apr. 25, 1911.

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To all whom it may concern:

Be it known that I, GERALD DEAKIN, a citizen of the United States of America, and a resident of Oakland, county of Alameda, and State of California, have invented a new and useful Improvement in Telephone Meter Systems, of which the following is a specification.

My invention pertains to systems for the automatic operation of central office connection counters in a telephone exchange.

My invention pertains to the systems and circuits rather than to any type of meter mechanism or to any specific apparatus in which my system and circuits may be embodied, except in so far as I may modify existing circuits or apparatus for adaptation to my system.

I provide a system in which an electrically controlled counting device or meter is associated with a subscriber's line, and is adapted by the circuits and mechanisms of the central office to record one additional unit upon its counting train, upon the first answering of a called line in response to a call originating upon the subscriber's line pertaining to the meter. I provide, further, means whereby lines for terminating calls are divided into two classes, the first class of which controls the meter of the calling line to record a unit upon the meter when first answering a call, and the second class of which does not control the meter to operate.

In an automatic telephone central equipment of any of the types now widely used, a line entering the office branches into two paths, one of which passes to the multiple terminals of the connectors and carries all calls in which that line is the called line; and the second of which extends toward the selectors and remains idle or is disconnected during the continuance of calls terminating upon the line, but carries the operating circuits of the line for all calls originating upon the line, the extension to the connector multiple remaining unused in such calls.

In my improved system of meter operation, I install a meter or a meter-controlling relay in the call-forwarding branch of the subscriber's line, thus placing it in a position where it is inactive upon any connection in which the call-receiving branch of the line is used. In the selectors or connectors I provide relays and circuits whereby the answering of a called line will increase the current upon the calling line; I adjust the meter or its controlling relay so as not to operate on the predetermined current value existing before the answering of the called line and so as to operate upon the predetermined larger current value existing after the answering of the called line. I provide upon the operating parts of the meter two electrical contacts operated successively and having the following functions: The contact first operated closes a locking circuit which holds the meter inert in its operated condition and not susceptible to further control by its line during the continuance of the then existing connection. The contact second operated removes the meter electrically from the line, leaving the line circuits clear and not modified or unbalanced during the conversation by reason of the presence of the meter in association with the line. To provide for unlocking the meter at the termination of the connection, that it may return to proper condition preparatory to recording upon an ensuing connection, I take the locking circuit through an electrical contact controlled by some unit of mechanism whose condition is changed incidentally to setting up the connection and which remains in its changed condition throughout the continuance of the connection; by the return to normal condition of idleness of this unit of apparatus, the locking circuit is interrupted and the meter is restored. The apparatus unit selected would be the first automatic switch involved in the connection, and if that switch be individual to the meter's line, the meter's locking circuit may take a contact upon any relay armature or other moving part fulfilling the required conditions. For controlling the current values upon the meter's line, I provide a relay in circuit with the called line having contacts upon its armatures to control the circuit of the calling line. To provide for the completion of connections with predetermined lines without involving the operation of the meter, I polarize the meter or its controlling relay and provide connecting units furnishing to the calling line current having a direction reversed as compared with the direction of the usual cur-

rent intended to operate the meter. Thus, connectors selecting lines of the free class shall have the reversed battery connections, and connections selecting lines of the ordinary class shall have the direct battery connection adapted to operate the meter.

In the regular operation of a telephone system in which the basis of charge to the subscriber for service is the number of calls he shall make in a given time, it is necessary to provide means whereby he will not be charged for certain calls, such as those in which he asks for information from the central office, those in which he makes a request for long distance service, and those in which he may wish to report telephone troubles. It is desirable, if possible, to arrange the call recording system so that these free calls will not be recorded in the meter. I accomplish this by polarizing the meter or its controlling relay, and by arranging that all such lines as shall receive free calls, shall be reached through special connecting units, which furnish to the calling line, upon the response of the called subscriber, current having a direction reversed as compared with its direction in the calling line on a call which is to be recorded. Thus, connectors having access to lines of the free class may have the reversed battery connections, and connectors having access to lines of the ordinary class, may have the direct battery connections adapted to operate the meter.

In the drawing, Figure 1 shows the general circuits embodying my device and arranged for the forwarding of calls of the regular class, in which each answered call will operate the meter. Fig. 2 shows the connector circuits in which the reversed current is furnished to the calling line, so as not to operate the meter upon the response of a called station to which calls are to be free.

Referring now to Fig. 1, 2 is a substation which may institute a call by removing the receiver from the hook and so bridging the telephone set upon the line. 3 is a similar substation to be called by substation 2. Both are of a type of automatic telephone apparatus now in common use, as also is true of the remainder of the connecting units which I show and describe in connection with my invention herein. Upon the rising of the switch-hook at substation 2, current from the battery B or other source of central office current, flows through the trip-magnet 4, the limbs of the line, the closed telephone circuit at 2, and again to the battery B. The trip-magnet 4 being energized, closes all of the contacts shown respectively as 5, 5^1, 5^2, and 5^3. These contacts are those in common use in individual switches of automatic telephone systems, and it is their regular office in such systems, as it is in Fig. 1, to extend the limbs of the calling line toward some idle connecting unit. Any of the usual methods whereby the individual switch containing the trip-magnet 4, selects and connects with the line to an idle connecting unit containing a branched relay, such as 6, are satisfactory arrangements for the operation of my device. For the sake of clearness, I have omitted from the trip-magnet 4, the means by which the contacts 5 to 5^3, are closed. I show in connection with the trip-magnet, however, the armature and contact 7. Whenever the trip-magnet 4 is energized, the contact at 7 is closed and so places ground upon the wire 8. No apparatus operates as a result of grounding the conductor 8 until a coöperating action shall take place.

The relay 9 is of similar character to the relay 6, both being, in general, the two relays customarily provided in a connector of an automatic telephone exchange, the regular office of such a connector being to find and connect with a called line in the multiple of lines to which the connector has access. The relays 6 and 9 respectively furnish current for conversation to the substations 2 and 3. These relays, as current supply bridges, are counterparts of current supply bridges in manual switchboard connecting cords, and the condensers 10 and 11 similarly interrupt the connecting circuit, so that direct current from the relay 6 may not pass to the substation 3, and vice versa. Further, the relay 6 is that which is known in ordinary automatic practice as "the front bridging relay" of the connector, and the relay 9 is that known as "the back bridging relay" of the connector. The relay 9 may be of whatever resistance the ordinary features of the particular system require. The relay 6, however, requires to have its windings specially related to my device, and a suggested arrangement of windings, and one which I find satisfactory in practice, is to have the windings *a* of 250 ohms each, and the windings *b* of 2000 ohms each.

12 is a polarized relay, for which I find a resistance of 50 ohms to be satisfactory. I have indicated by an arrow below the relay 12, the direction in which its armature tends to move whenever current from the relay 6 passes through the limbs of the line and the substation 2; but I arrange the adjustment of the relay 12 and the voltage of the common battery B such that, unless the contacts 13 and 13^1 of the relay 9 are closed, not enough current can flow through the relay 12 to operate it. This is for the reason of the high resistance of the windings *b*, but if these are placed in shunt with the windings *a*, a much larger current will flow through the relay 12, and it will operate, with the results yet to be described.

14 is a service meter consisting of an elec-

tro-magnet of two windings, both having connection with the main central source of current, as battery B. The armature of the magnet is connected by a pawl with the ratchet wheel 15 of a train of counting wheels. This train may be of any of the well-known types, arranged in a ratio of ten-to-one, so as to count the successive conversations and show the total count on the several wheels. Connected as shown in Fig. 1, the meter 14 will operate, if the relay 12 shall close its contact at 16 while the contact at 7 also is closed. This will result because of the winding *c* of meter 14 receiving current. The contact 17 will close as a first consequence of the movement of the armature of the meter. Thereafter, the contact at 18 will be closed, and, as a final result, the wheel 15 will be turned far enough to complete the registry of one unit on the meter train. But the closing of the contact 17 furnishes current through the winding *d* and the contact 7, and the closing of the contact 18 short-circuits the relay 12. This, in turn, permits the breaking of contact 16, but the meter still remains energized, being locked through the contact 17 until the contact 7 shall break. For the windings *c* and *d*, I have found the resistance of 200 ohms and 3000 ohms respectively to be satisfactory. In the act of making a call, therefore, the subscriber at substation 2 closes his line at the switch-hook, and by means of the usual dial, interrupts the line in series of impulses at 19. The closing of the line operates the trip-magnet 4, grounds the conductor 8 at 7, and closes all the contacts 5, 5^1 5^2, and 5^3. Relay 20 now is energized by current from battery B through itself to ground at 5^2. Trip-magnet 4 thus is cut off from the line, but as it has operated to trip or release mechanism to close contacts 5 to 5^3, which contacts remain closed till released by the release magnet 22, so also it holds contact 7 closed, as is usual in contacts associated with such tripping of individual automatic switches. The impulses caused by the breaking of contact 19 at the substation, now operate relay 6 of the connector, and by mechanism which I do not show, but which is well known in the art, the connector responds to such impulses by moving its line wipers to find the called line. When the called line has been rung upon in the usual way and the subscriber responds at substation 3, relay 9 is energized. The closing of contacts 13 and 13^1 places the windings *a* in shunt with the windings *b* in relay 6, and, as a consequence of this shunting, an increased volume or current flows to substation 2 through the relay 12. Relay 12 closes contact 16. Meter 14 operates, closing contacts 17 and 18 in the order mentioned, and counting one on the meter train. The meter locks, as described, and the relay 12 is short-circuited, leaving the limbs of the line again balanced in resistance. The conversation having been finished, the hanging up of the receiver at substation 2 opens the line, releasing relay 6 of the connector. In the usual way, through contacts not shown in Fig. 1, the connector releases and returns to its normal position. In so doing, a ground is placed on conductor 21, energizing release magnet 22. This magnet is the usual one of individual switches in standard automatic systems, and its office is to restore the individual switch to normal condition, opening the contacts 5 to 5^3, and contact 7. As 7 opens, meter 14 is no longer energized by either of its windings and so releases, restoring itself to condition to record on a succeeding call.

The conductors *f* and *g* are a metallic circuit branch of the line leading to connector contacts, and it is over them that terminating calls are made to substation 2. The conductor *h* will be grounded by such a terminating call, and so will operate the relay 20, thus removing the trip-magnet 4 and the ground at B from the line while such a terminating call is in progress. As the trip-magnet cannot operate while relay 20 is energized, no terminating call for substation 2 can operate the meter 14.

In Fig. 2, I show a connector in which the relation of battery B to the relay 6 is reversed. It is such a connector as would contain lines for whose terminating calls no charge is to be made on the meter of the calling line. The relay 6 of such a connector will give current to the calling line in a direction tending to operate the armature of the relay 12 opposite to the direction of the arrow, or, in other words, in the direction of the natural tendency of the armature when at rest. The contact 16, therefore, cannot be closed whether the relay 9 be opened or not, so that, lacking the coöperation of the contact 16, the contact 7, though closed, cannot record a call.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. In a meter system, a line having two central office branches; a meter-controlling winding included serially in one of said branches; automatic means for connecting the line through said branch and said meter winding when forwarding a call originating upon the line; and means for increasing the current upon the line and through said meter winding to an operative value for said meter, substantially as described.

2. In a meter system, a line having two metallic circuit branches at the central office; a meter-controlling winding included serially in one of said branches; means for connecting the line through said branch and said winding when forwarding a call originating upon the line; means for varying the

current value upon the line and through said meter winding; and a called line and substation, said means for varying the current value through the meter-controlling coil being controlled by the substation apparatus of said called line, substantially as described.

3. In a meter system, a meter having a controlling coil serially in the telephone line; a locking circuit for said meter and having a contact controlled by said meter; and another contact upon said meter short circuiting said line winding, substantially as described.

4. In a meter system, a meter having a polarized controlling coil serially in the telephone line; a locking circuit for said meter and having a contact controlled by said meter; and another contact upon said meter and short circuiting said polarized line winding, substantially as described.

5. In a meter system, a telephone line; an automatic selecting switch for connecting said line to others, a meter having a controlling coil serially in the telephone line; a locking circuit for said meter and having a contact controlled by said meter; and means for interrupting said locking circuit, said means being rendered operative by the disconnection of the selecting switch, substantially as described.

6. In a meter system, a calling line; a called line; an automatic switch for connecting them; a polarized meter coil in said calling line; means for passing through said coil current of proper direction but insufficient to operate said meter; and a relay controlled by said called line and adapted to increase the current in said calling line to operate said meter, substantially as described.

7. In a meter system, a calling line; a called line; an automatic switch for connecting them; a meter coil in said calling line; means for passing through said coil current insufficient to operate said meter; and a relay controlled by said called line and adapted to increase the current in said calling line to operate said meter, substantially as described.

Signed by me at San Francisco, county of San Francisco and State of California, in the presence of two witnesses.

GERALD DEAKIN.

Witnesses:
JOHN D. GISH,
H. B. CUTTING.