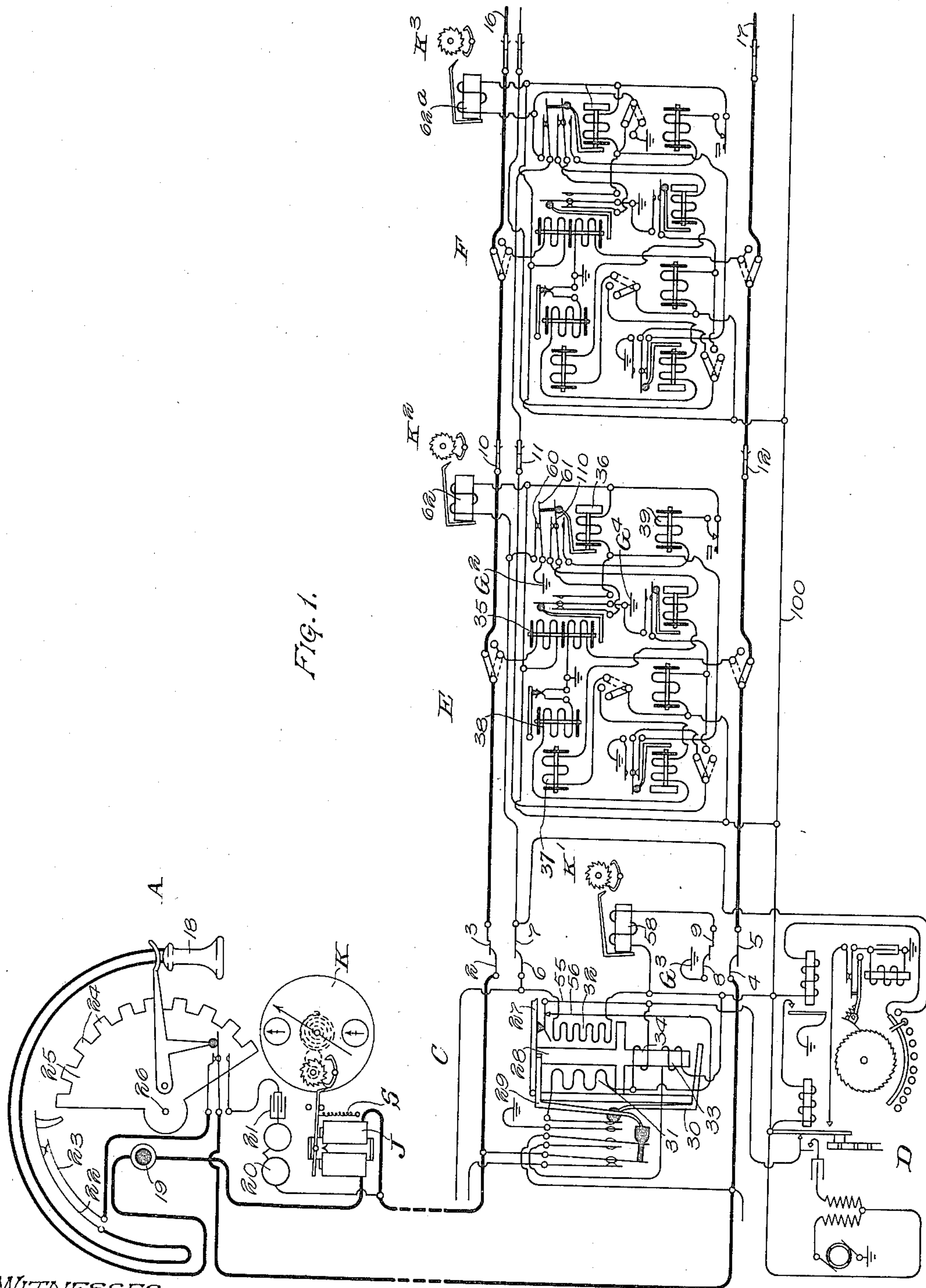


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H. D. STROUD,
TELEPHONE METER SERVICE SYSTEM.
APPLICATION FILED APR. 3, 1913.

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2 SHEETS—SHEET 1.



WITNESSES

Albert Andersen.
Arthur J. Ray.

INVENTOR:

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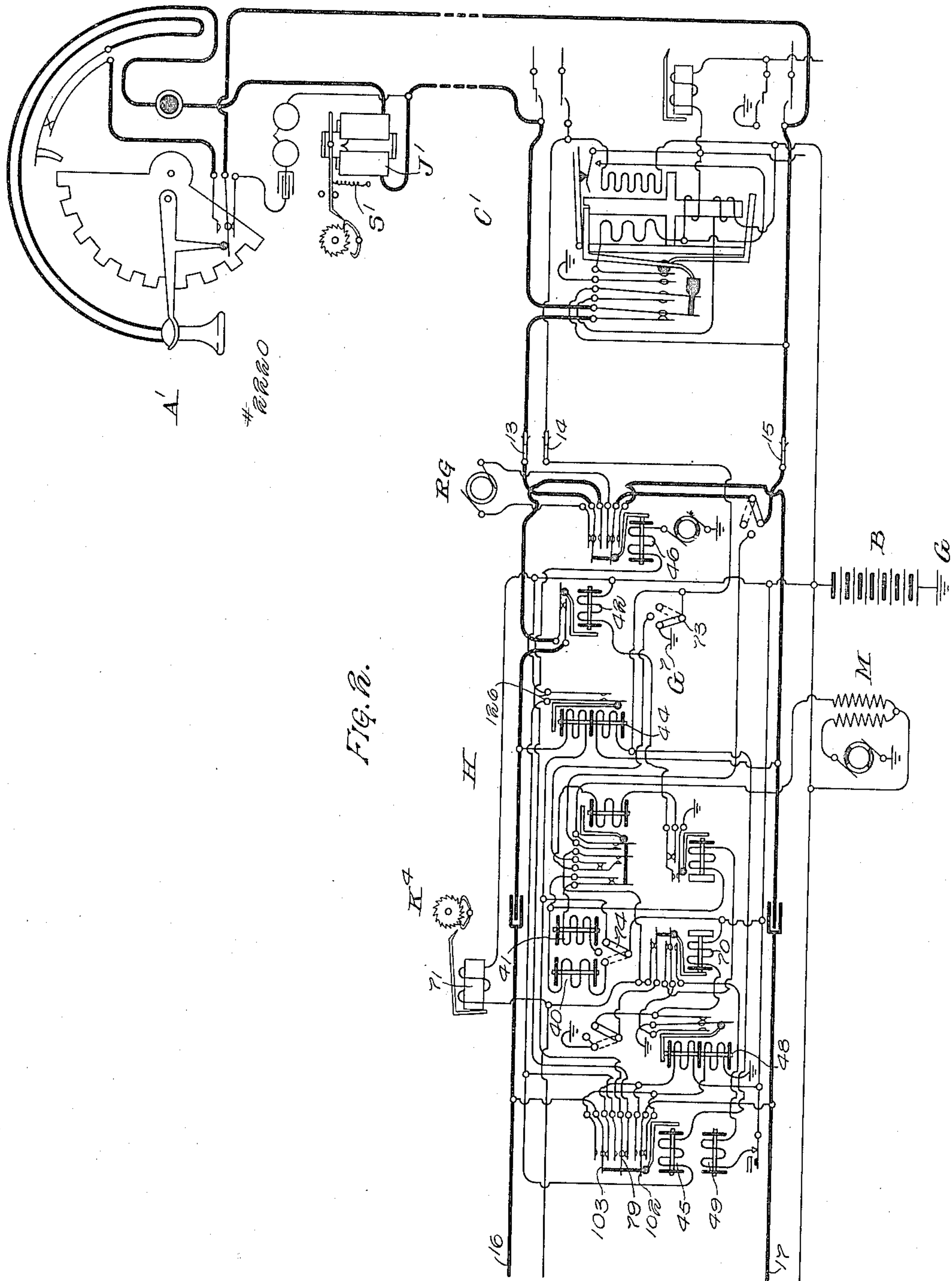


Fig. 2.

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UNITED STATES PATENT OFFICE.

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TELEPHONE METER-SERVICE SYSTEM.

1,254,290.

Specification of Letters Patent.

Patented Jan. 22, 1918.

Application filed April 3, 1913. Serial No. 758,635.

To all whom it may concern:

Be it known that I, HAROLD D. STROUD, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone Meter-Service Systems, of which the following is a specification.

My invention relates to registers for telephone systems, and more particularly to an arrangement in an automatic telephone system for recording the actual length of time during which a line is in use. Heretofore it has been customary to provide a meter which merely registered the number of calls without taking into account the actual time during which a line was in use.

The object of my invention is to provide a meter which, instead of registering the number of calls, registers the total time during which the telephone is in use.

A further special object of my invention is the provision of a spring-operated register which is normally locked and which is released upon the response of the called subscriber, and is again locked when the conversation is completed.

A still further feature of my invention is the provision of a time meter associated with each of the automatic switches which are employed in establishing a connection, the purpose of which meter is to register the exact time that these switches remain in operative condition, it being often advisable to know just how much certain switches are operated—that is, to know the total length of time a switch is busy during a certain given period.

These and other objects of my invention will be more readily understood by reference to the accompanying drawings, in which is represented diagrammatically a complete connection between a calling substation A and a called substation A' in a telephone system embodying the principles of my invention.

Figure 1 illustrates a subscriber's telephone instrument connected to conductors terminating at the central office in a line or individual switch C which, by means of a plunger (not shown) and the bank springs 2 to 9 inclusive, is adapted to extend connection to a first selector E. In connection with the line switch C is shown a master

switch D for controlling all the plungers of a group of line switches to which a switch C belongs. This group of line switches has common access to trunk lines leading to first selectors which are adapted to extend the connection to second selectors such as the second selector F. From the second selector F the connection is extended to a connector such as the connector H (Fig. 2), through the medium of which the line is connected by way of certain springs of the line switch C' to the called subscriber's substation A'.

The telephone may be of any suitable automatic common battery type. As herein represented it consists of a receiver 18, transmitter 19, ringer 20 and condenser 21. Being an automatic telephone it is also provided with the impulse springs 22 and 23 and an impulse wheel 25 which has a plurality of teeth 24 upon its periphery. This wheel is secured to a shaft 26 upon which is also secured a dial (not shown). This dial is provided with finger holes around its edge for convenience in rotating, and the impulse wheel 25, upon returning to its normal position by means of a spring after being pulled around corresponding to the digit to be called, opens and closes the impulse springs 22 and 23 a corresponding number of times.

The line switch C, which is individual to the line of the substation A, and the master switch D are modified forms of the general type of line switch and master switch disclosed in British patent to R. W. James No. 26,301 of 1906, being of the particular type shown in British patent to S. G. S. Dicker No. 10,926 of 1911. As herein represented, the line switch C comprises among other details a plunger (not shown) attached to the end of a plunger arm 27. This plunger arm is controlled by a magnet 28 which also controls the armatures 29 and 30. The magnet 28 is composed of four distinct windings, a pull-down winding 31, a hold-down or cut-off winding 32, a line winding 33 and an auxiliary winding 34. The magnetic circuit of the windings 31 and 32 are kept separate from the windings 33 and 34. The plungers of the line switches normally engage with a so-called plunger guide shaft which is controlled by the master switch D, the function of which shaft is to maintain the idle plungers opposite an idle trunk.

The first and second selectors E and F are of the type disclosed in British patent to S. G. S. Dicker No. 10,926 of 1911, above referred to, and comprise, in the case of selector E, the line relay 35, which is placed across the line and energized the instant the selector is engaged, the release relay 36, the vertical and rotary magnets 37 and 38 and the release magnet 39. These selectors are also provided with the usual side switch.

The connector H is of the general type disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, the circuits, however, being modified, as shown in said British patent No. 10,926 of 1911, in order to adapt the switch for operation in a two-wire system. Like the selectors, the connector is provided with a shaft (not shown) which carries the wipers 13, 14 and 15 onto the desired contacts. This shaft is raised and rotated by means of the vertical and rotary magnets 40 and 41. The side switch is controlled by the private magnet 42 in the usual manner. This connector is also provided with a so-called back-bridge relay 44 which is the means of providing talking battery current to the called subscriber, and which also operates upon the response of the called subscriber to cause the battery current in the calling subscriber's line to be reversed to operate the polarized magnet J, which latter operates its armature at this time to release the escapement of the time-piece K and thus starts to record the length of time the subscribers are conversing. Ringing current is supplied to the called subscriber's line by means of the relay 46 and the ringing machine RG. Connected across the line is the usual line relay 48, which is energized immediately when the line connection is extended to the connector. For the purpose of releasing the connector there is provided the usual release magnet 49.

The line switch C' is in every respect like the line switch C, and although the master switch which controls the plungers of the group of line switches to which the switch C' belongs is not shown, it can be of the same time as that shown at D in Fig. 1. The meter mechanism and telephone at the substation A' are the same as the meter and telephone shown at the substation A.

The operation of such a system is well known and understood to those skilled in the art, and as the particular construction and operation of this system forms no part of my present invention it is not thought necessary to explain the same further in detail.

The principal feature of my invention lies in the meter arrangement for the purpose of measuring the actual time which is taken up by one subscriber conversing with another. This arrangement consists of a polarized magnet J in series with one side

of the line, the armature of which magnet is normally held down on one side by a spring s to engage with the escapement of a time-piece K to prevent it operating. The time-piece K is shown only diagrammatically, as it may be of any suitable construction, such, for instance, as an ordinary spring-driven watch movement. It should, however, be capable of registering the maximum total time which the telephone is liable to be used during a somewhat extended period, say, for instance, a month. Upon the calling subscriber taking his receiver off the switch hook a current is sent through the polarized magnet in the direction to keep its armature drawn down so as to continue in engagement with the escapement of the time-piece. The armature is thus attracted until the flow of current is reversed at the connector switch upon the called subscriber answering the call. This reversal of current is controlled by the energization of the so-called back-bridge relay 44. This relay, upon energizing, closes a circuit through the battery-reversing relay 45 from ground G' through the side switch wiper 73, relay 45 and springs 126 to the battery B. Upon the relay 45 energizing it forms a locking circuit for itself, said circuit extending from ground G' through the side switch wiper 73, relay 45, through the front contact of the spring 79 and through the side switch wiper 74 to the battery B. Upon the relay 45 becoming energized the springs 102 and 103 break away from their back contacts and close their front contacts, thus transferring the negative line to the positive pole of the battery and the positive line to the negative pole of the battery through the line relay 48. The flow of current thus reversed operates the polarized magnet J at the calling substation so as to attract its armature to release the escapement of the time-piece K and thus hold it until the connection is released. It is thus seen that the calling subscriber's register begins to operate only when the called subscriber responds, so that the subscriber is not charged with the time taken to set up connection or for the called subscriber to answer, but is charged only from the time the conversation begins.

Upon the subscribers completing their conversation the central office apparatus is restored to normal condition by the calling subscriber hanging up his receiver in the usual and well-known manner. Battery current then ceases to flow through the polarized magnet J at the calling telephone and its armature is accordingly allowed to return to its normal position into engagement with the escapement of the time-piece K to thus stop the operation of the meter. It will be noticed that the operation of the meter is dependent upon the reversal of cur-

rent caused by the answering of the called subscriber. If an attempt is made to make connection with a busy line, this reversal of current does not occur and accordingly
 5 no record of such a call will be made upon the calling subscriber's meter. As shown herein, the calling subscriber's meter begins to record the conversation as soon as the called subscriber removes his receiver from
 10 the switch hook, and comes to rest only when the calling subscriber hangs up his receiver to release the connection. If it is desired that the called subscriber shall be able to bring the meter of the calling sub-
 15 scriber to rest upon the hanging up of his receiver, the front contact of the spring 79 of the relay 45 of the connector switch may be omitted. Without this contact the relay 45 will be energized when the called sub-
 20 scriber hangs up his receiver. This will restore the current in the calling line to its normal direction, whereby the armature of the magnet J will be brought into engage-
 25 ment with the escapement of the time-piece K and it will be brought to rest notwithstanding that the calling subscriber may not yet have hung up his receiver.

In order to determine the time during which each switch in the system is in use
 30 a register similar to the one shown at the substation A is associated with each switch, and these are represented at K', K², K³ and K⁴ by an escapement wheel and lever. Unlocking magnets 58, 62, 62^a and 71 are
 35 associated with these registers, but these magnets differ from the magnet J by reason of the fact that they are not polarized. The unlocking magnet 58, which is associated with the line switch C, is connected with the
 40 spring 9, so that as soon as this line switch is operated to connect with an idle trunk line, this spring comes into contact with the spring 8 and thus closes the circuit of the magnet 58. It is obvious that this circuit
 45 will be closed as long as this line switch is in operated condition, but as soon as the line switch is released this magnet will be de-energized and the meter again locked. In a similar manner the unlocking magnet 62 of
 50 the first selector is energized as soon as the slow acting relay 36 is energized, so as to close the circuit of the said magnet 62 through the springs 60 and 61 to ground G². This slow acting relay 36 is energized in a
 55 well-known manner as soon as the first selector is seized, for upon the springs 2, 3, 4, and 5 of the line switch being pressed together, and the connection extended to the first selector E, the line relay 35 becomes
 60 energized and closes the circuit from ground G² through its front contact and through the slow acting release relay 36 to the battery lead 100. In a similar manner the un-
 65 locking magnet 62^a of the second selector is energized as soon as connection is extended

to this selector. In a like manner the un-
 locking magnet 71 associated with the meter of the connector is controlled through the slow acting relay 70, which is energized as
 in the preceding switches as soon as the con- 70
 nector is seized. In each instance it is obvious that the unlocking magnets are main-
 tained energized as long as the switches are operated, but as soon as the switches are re-
 leased and returned to normal position these 75
 magnets are deenergized and their arma-
 tures thus fall back and again lock the cor-
 responding meter. It will thus be seen that I have devised a very simple and efficient
 arrangement for measuring the exact length 80
 of time that each of these switches is in use.

While I have illustrated the registering devices associated with the substation and with the automatic switches in connection with an automatic telephone system of a
 85 particular type, it is, of course, understood that my invention is not limited to use in such a system. The registering device at the substation may be employed with any auto-
 matic system of a well-known type, and in 90
 its broader aspect my invention may be employed in connection with either manual or semi-automatic systems. Furthermore, the meter device associated with the automatic
 switches can, of course, be associated with 95
 automatic switches of any desired type.

What I claim as my invention is:—

1. In a telephone system, an automatic switch, means for seizing said switch, means
 for operating said switch and for releasing 100
 the same, a time register associated with said switch, means for starting said register in operation when said switch is seized, and means for stopping said register when said
 switch is released, whereby said register 105
 automatically records the length of time that said switch is in use.

2. In a telephone system, an automatic switch, means for seizing said switch, means
 for operating and releasing the same, a time 110
 register associated with said switch, means normally locking said register against operation, a magnet controlling said locking means, means for energizing said magnet
 when said switch is seized to thereby release 115
 said register, and means for deenergizing said magnet when said switch is released to thereby again lock said register.

3. In a telephone system, a plurality of subscribers' lines, a series of automatic 120
 switches for use in establishing a connection between two of said lines, a time register associated with each of said switches, means normally locking said time registers against operation, means for unlocking a time regis- 125
 ter as soon as its associated switch is seized, and means for again locking said time register when its associated switch is released.

4. In a telephone system, subscribers' lines each provided with an individual line or 130

trunk selecting switch, a time register associated with each switch, means controlled over a calling line for operating its individual switch upon the initiation of a call and for releasing the operated switch when disconnection is desired, and a circuit for controlling the operation of the associated time register, said circuit being closed when the

associated switch is operated and opened when it is released.

Signed by me at Chicago, Cook county, Illinois, this 26th day of March, 1913.

HAROLD D. STROUD.

Witnesses:

ALEX E. WALKER,
ARTHUR J. RAY.