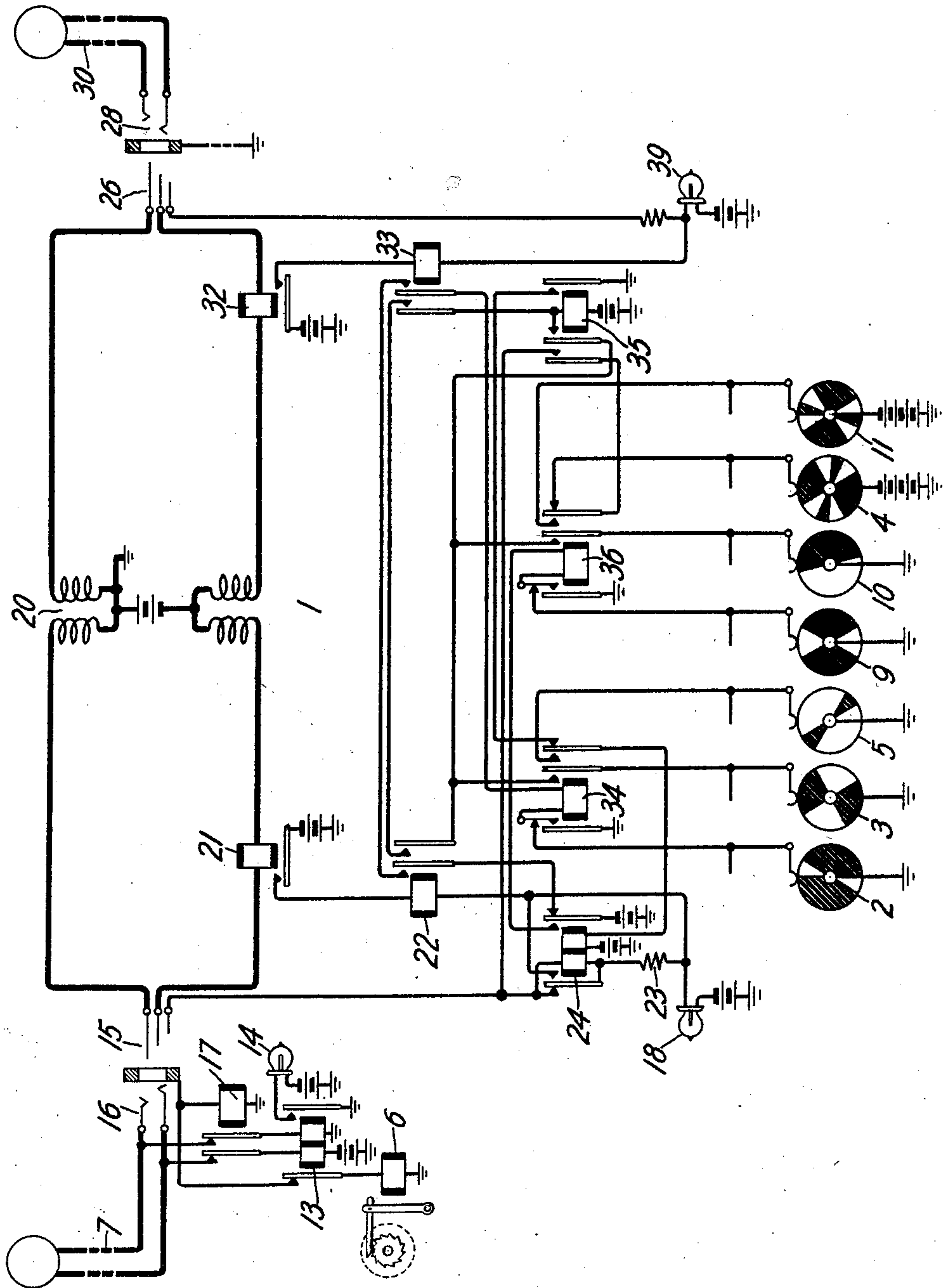


Feb. 7, 1928.

1,658,197

E. E. HINRICHSEN
TELEPHONE EXCHANGE SYSTEM

Filed Nov. 2, 1926



Inventor:
Edward E. Hinrichsen.
by Joel C. Palmer
Attorney.

UNITED STATES PATENT OFFICE.

EDWARD E. HINRICHSSEN, OF NEW YORK, N. Y., ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TELEPHONE-EXCHANGE SYSTEM.

Application filed November 2, 1926. Serial No. 145,756.

This invention relates to metering systems for telephone exchanges and more particularly to a system of charging for telephone service based on the principle of making a charge when a conversational connection is completed and additional charges at predetermined intervals during the conversational period.

In accordance with this invention a metering system including a plurality of interrupters is so arranged that the usual meter associated with the calling subscriber's line is actuated, under control of certain of said interrupters when the calling subscriber's line is connected with a called subscriber's line and the called subscriber has answered, to register an initial connection completed charge, and so arranged that the meter is thereafter actuated under control of certain other interrupters to register additional charges at predetermined intervals during the conversational period. These latter charges may be called conversational charges.

The invention has been illustrated in the accompanying drawing in which a calling subscriber's line and a called subscriber's line are shown with a cord circuit for connecting the same.

Referring now to the drawing, the series of interrupters shown are connected to the cord circuit 1 in such a manner that interrupters 2, 3, 4 and 5 are used in the control of a meter such as 6 of the calling subscriber's line 7 to register the initial connection completed charges and the interrupters 9, 10 and 11 are used in the control of the meter to register the additional conversational charges. These interrupters are common to a plurality of cord circuits such as 1.

Interrupter 2 is known as a pick-up interrupter and functions to render the timing circuit for the initial charge effective. Interrupter 3 is a timing interrupter for counting time for the initial charge and operates over the timing circuit rendered effective by the pick-up interrupter 2. Interrupter 4 is a charging interrupter for making the initial charge and operates during the time that the timing circuit under control of interrupter 3 is rendered effective. When the called subscriber answers so that a change in the rate of charging has to be made the

change-over interrupter 5 becomes effective. Thereupon interrupter 9 known as a pick-up interrupter for the conversational charge renders the conversational charge timing circuit effective. Thereupon timing interrupter 10 operates over the timing circuit to render the charging interrupter 11 effective.

Assuming now that the subscriber of line 7 removes his receiver from the hook, a circuit is completed for the operation of the line relay 13. The operation of this relay closes a circuit for lighting a line lamp 14. The operator in charge of cord circuit 1 in answering this call inserts plug 15 into jack 16 of line 7. This causes the operation of cutoff relay 17 and the lighting of supervisory lamp 18 through the sleeve circuit. The operation of cutoff relay 17 releases the line relay and the line lamp 14 is extinguished. The release of line relay 13 connects the calling subscriber's meter 6 to the sleeve circuit but the characteristics of this circuit are such that the meter will not be actuated at this time. The supervisory relay 21 of cord circuit 1 is now also operated through the subscriber's loop from the battery connected through the left hand windings of the repeating coil 20. The operation of supervisory relay 21 closes a circuit for the operation of relay 22, as follows: battery, armature and front contact of relay 21, winding of relay 22, resistance 23, left hand armature and back contact of relay 24 through the sleeve circuit and winding of cutoff relay 17 to ground. Lamp 18 is now extinguished as it is shunted by the winding of relay 22.

The operator now communicates with the calling subscriber by operating the usual talking key in the cord circuit (not shown), and when the desired number is received she will insert 26 into jack 28 of the wanted subscriber's line 30 and operate the usual ringing key (not shown), to call the subscriber. When the called subscriber on line 30 answers, the supervisory relay 32 is operated and this relay in turn closes an obvious circuit for the operation of relay 33 and extinguishing of lamp 39 which was lighted on the insertion of plug 26 into jack 28. Relay 33 in operating closes a circuit for the operation of relay 34 when the interrupter 2 is in position to connect ground to the

make-before break contact of relay 34. This circuit may be traced as follows: battery, right hand armature and back contact of relay 24, inner right hand armature and front contact of relay 22, inner left hand armature and front contact of relay 33, winding and make-before-break contact of relay 34 through the interrupter 2 to ground. Relay 34 in operating provides a locking circuit for itself through its left hand armature and front contact to ground independent of the ground supply through interrupter 2. This relay 34 in operating now completes a connection for the intermittent operation of relay 35 as follows: battery, winding of relay 35, outer left hand armature and front contact of relay 33, outer right hand armature and front contact of relay 22, inner right hand armature and front contact of relay 34 to ground at interrupter 3. Interrupter 3 completes this circuit intermittently and relay 35 is therefore intermittently operated as stated. The relation of the connections to ground from the interrupters 2 and 3 is such that the ground will be removed from the circuit through interrupter 2 a certain period before it is applied to the circuit through the interrupter 3, to permit relay 34 to release within that period without ground being applied to the circuit for relay 35. This is necessary in order to prevent false operation of the meter 6 in case the plug 26 has been connected to a busy back jack, that is, the interval between the operation of relays 34 and 35 is such that if the operation of the supervisory relay 32 is due to a busy back jack connection, relay 32 will be released by the busy back interrupter before relay 35 has time to operate.

Assuming, however, that relay 34 remains operated, as would ordinarily be the case when the calling subscriber answers, relay 35 will operate when ground is applied through the interrupter 3 at the end of said period. Relay 35 in operating will now apply a metering potential from interrupter 4 to the sleeve circuit for the operation of meter 6 over a circuit as follows: from battery through the interrupter 4, outer right hand armature and back contact of relay 36, outer left hand armature and front contact of relay 35 through the sleeve circuit, left hand armature and back contact of line relay 13, winding of meter 6 to ground. It will be noted that the application of a metering potential through the segments of interrupter 4 may be such that two or more impulses or metering potential may be applied for the operation of the meter dependent upon the manner in which the registration on the meter is to take place. The operative and non-operative segments of the interrupters 3 and 4 have been so arranged that during the operation of relay 35, two impulses of metering potential are applied to meter 6. When relay 35 is released due to the ground being removed through interrupter 3, a ground is applied through interrupter 5 for the operation of relay 24 as follows: battery, right hand winding of relay 24, outer right armature and front contact of relay 34 to ground at the interrupter 5. Relay 24 in operating its left hand armature includes its left hand winding in series with the resistance 23 in the sleeve circuit so that this relay 24 will now remain operated as long as plug 15 remains inserted in jack 16 independent of the energizing circuit through its right hand winding. The operation of relay 24 causes the release of relay 34 by the operation of its right hand armature and closes a circuit for the operation of relay 36 as follows: battery, right hand armature and front contact of relay 24, winding and make-before-break contact of relay 36 to ground which will be connected through a segment of interrupter 9, that is, a ground will be connected to interrupter 9 a certain interval after the connection of ground to interrupter 5 so as to permit the first conversational period to elapse before any additional charge is made as will be hereinafter described. When relay 36 operates it provides a locking circuit for itself through its left hand outer front contact independent of the ground applied by interrupter 9. This relay 36 in operating closes a circuit for the operation of relay 35 as follows: battery, winding of relay 35, outer closed contacts of relay 33 and 22, inner right hand armature and front contact of relay 35 to ground through the interrupter 10. This interrupter at this time supplies ground and this ground is supplied and removed thereafter at certain intervals to allow for the subsequent operations of the register during succeeding fixed conversational periods for which cumulative charges are to be made. These periodic charges are controlled during the succeeding conversational periods by interrupter 11. That is, during each of such periods that relay 35 is maintained operated by interrupter 10 metering potential from interrupter 11 is applied to the sleeve circuit to operate the meter 6 in the desired manner. For example, the meter may receive one or more impulses of metering potential depending on the cutting of the interrupter 11 during each of such periods to actuate the meter the desired number of times, to register the desired charge thereon. In this case the meter will be operated twice during each operation of the relay 35. The cuttings of the interrupter 10 therefore represent periods during which charges are to be made and the cuttings of the interrupter 11 represent the number of times the meter is to be operated during such periods. It should be noted that the metering potential as applied

through interrupter 11 will reverse the current in the left hand winding of relay 24. Hence, to prevent relay 24 from releasing during the periods relay 35 is operated, a
 5 circuit is completed through the right hand winding of relay 24 which maintains it operated. This circuit may be traced as follows: battery, right hand winding of relay 24, outer right hand armature and back con-
 10 tact of relay 34, right hand armature and front contact relay 35 to ground.

Relay 35 in operating locks up independently of the contacts of relays 22 and 33 through its inner left hand armature and
 15 front contact under control of the ground applied at the interrupter 10 so that if either of the subscribers should operate the switch-hook while this relay is operated it will not interfere with the proper operation of meter
 20 6 during this period. This condition is also guarded against during the establishing charge period as interrupter 3 will maintain relay 35 operated independent of relays 22 and 33 while interrupter 4 is applying the
 25 metering potential.

It is evident that the cutting of the cams 2 to 5 and 9 to 11 may be different from those shown in the drawing to operate the
 30 meter 6 a different number of times at the time a called subscriber answers and during each charging period thereafter as well as to arrange for the charging periods during a conversational connection to take place at different intervals. The particular cuttings
 35 shown on the interrupters are therefore merely illustrative of one method of operating the meter.

When either of the subscribers hangs up his receiver at the end of a conversation the
 40 corresponding supervisory relay will be released and this relay in turn will release relay 22 or 33. Either of these relays will open the circuit for relay 35 so as to prevent metering potential from being applied after
 45 the next preceding application as determined by the cuttings on interrupter 10. When the called subscriber hangs up his receiver it is evident that lamp 39 will light and the operator will then take down the
 50 connection by removing plug 26 from jack 28 and plug 15 from jack 16 thus causing the release of relays 24 and 36.

It is evident that this invention is not limited in its use to any particular telephone
 55 system but may be employed in any systems where it is necessary to make cumulative service charges.

What is claimed is:

1. In a telephone system, a calling line, a
 60 meter associated therewith and means for operating said meter comprising a timing circuit, a pick-up interrupter for rendering said timing circuit effective, a charging circuit, a timing interrupter operating over
 65 said timing circuit to render said charging

circuit effective, and a charging interrupter for operating said meter over said charging circuit.

2. In a telephone system, a calling line, a meter associated therewith, a called line and
 70 means responsive to the establishment of a conversational circuit from said calling line to said called line for operating said meter comprising a timing circuit, a pick-up in-
 75 terrupter for rendering said timing circuit effective, a charging circuit, a timing interrupter operating over said timing circuit to render said charging circuit effective, and a charging interrupter for operating said
 80 meter over said charging circuit.

3. In a telephone system, a calling line, a meter associated therewith, a cord circuit for extending said line and a plurality of
 85 periodic interrupters associated with said cord circuit for controlling said meter, said interrupters being constructed and arranged in a circuit whereby a first interrupter pre-
 90 pares a circuit, a second interrupter operates in said prepared circuit and prepares a secondary circuit, and a third interrupter op-
 95 erates over said secondary prepared circuit to cause the operation of said meter.

4. In a telephone system, a calling line, a meter associated therewith, a cord circuit for
 100 extending said line, a charging circuit associated with said cord circuit, an interrupter for operating said meter over said circuit, a timing circuit and a timing interrupter operating thereover for rendering said charging
 105 circuit operative, and an interrupter for rendering said timing circuit operative.

5. In a telephone system, a calling line, a meter associated therewith, a cord circuit for
 110 extending said line, a connection charge circuit associated with said cord circuit, a connection charge interrupter for operating said meter over said circuit, a timing circuit and a timing interrupter operating there-
 115 over for rendering said connection charge circuit operative, a connection charge pick-up interrupter for rendering said timing circuit operative, a conversational time unit charge circuit associated with said cord cir-
 120 cuit, a conversational time unit charge interrupter for operating said meter over said conversational time unit charge circuit, a timing circuit and an interrupter for measuring conversational time units operating
 125 thereover for periodically rendering said conversational time unit charge circuit operative, a conversational time unit charge pick-up interrupter for rendering said last timing circuit operative, and means effective after the period measured by said first tim-
 130 ing interrupter for rendering said connection charge circuit ineffective and for rendering said conversational time unit charge pick-up interrupter effective.

6. In a telephone system, a calling line,
 130 a called line, a cord circuit for interconnect-

ing said lines, a meter associated with the
said calling line and means responsive to
the establishment of a conversational cir-
cuit from said calling line through said cord
5 circuit to said called line for operating said
meter to make a connection charge and re-
sponsive to the maintenance of said conver-
sational circuit for subsequently and period-
ically operating said meter to make conver-
10 sational charges, said means comprising a
pick-up, a timing and a charging inter-
rupter for making the said connection

charge, a pick-up, a timing and a charging
interrupter for making the said conversa-
tional charges, and a change-over inter- 15
rupter responsive to the circuit changes pro-
duced by said connection charge interrupters
for rendering said connection charge inter-
rupters ineffective and for rendering said
conversational charge interrupters effective. 20

In witness whereof, I hereunto subscribe
my name this 29th day of October, A. D.,
1926.

EDWARD E. HINRICHSSEN.