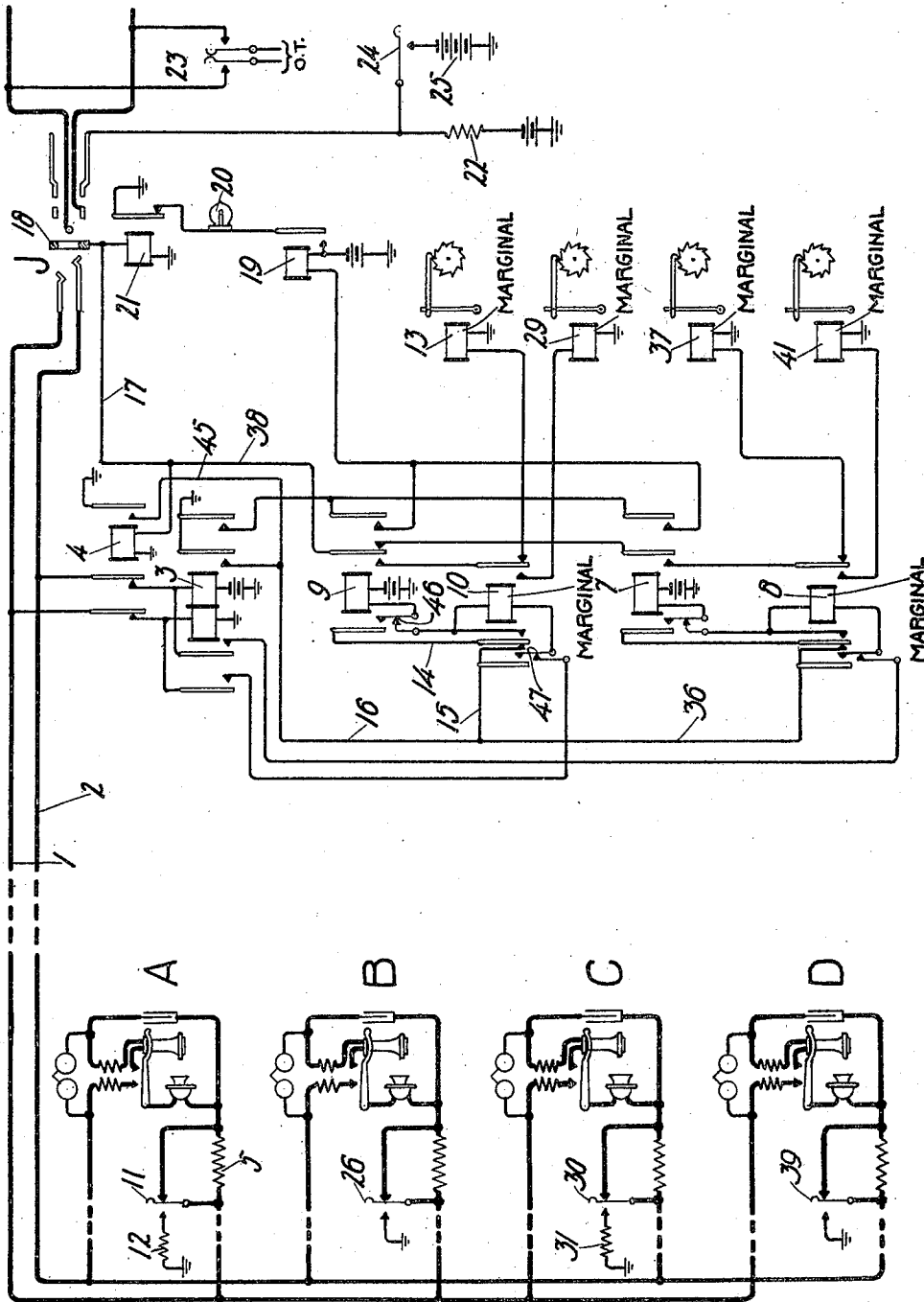


J. A. HALL.
 PARTY LINE METERING SYSTEM FOR TELEPHONE EXCHANGES.
 APPLICATION FILED NOV. 19, 1919.

1,383,805.

Patented July 5, 1921.



Inventor
 John A. Hall
 by *C. Soper* Att'y.

UNITED STATES PATENT OFFICE.

JOHN A. HALL, OF BAYSIDE, NEW YORK. ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PARTY-LINE METERING SYSTEM FOR TELEPHONE-EXCHANGES.

1,383,805.

Specification of Letters Patent.

Patented July 5, 1921.

Application filed November 19, 1919. Serial No. 339,179.

To all whom it may concern:

Be it known that I, JOHN A. HALL, a citizen of the United States, residing at Bayside, in the county of Queens, State of New York, have invented certain new and useful Improvements in Party-Line Metering Systems for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone exchange systems employing party line working, and wherein each of the stations of the party line is provided at the central office with a meter for registering calls from that station.

Its object is to provide an improved circuit arrangement for systems of this character wherein the subscriber in initiating a call causes his particular meter to be selected and connected to the metering circuit, which circuit may be subsequently closed either by the operator depressing a key, or automatically by relay operated due to the response of the called party, or in any other suitable manner.

In accordance with this invention where the party line has only two stations a pair of relays is provided at the central office, one of which is marginal. When the line relay is energized due to the removal of the receiver at the calling station of the party line it connects these relays to one side of the line. A manual switch is provided at each station of the line in addition to the ordinary hook switch for the telephone receiver. When the switch at one of the stations is actuated, it places a dead ground on the side of the line referred to. When, however, the switch at the other station is actuated it grounds the said side of the line through a resistance. In the former case both of said relays operate and this combination connects the meter of the calling station to the metering circuit. In the latter case, only one of the relays operates and the resulting combination connects the other meter in the metering circuit.

In the case where there are four substations on a line, a second pair of relays similar to the first pair is provided. When the line relay operates due to the initiation of a call, it connects one pair of relays to each side of the line, the manual switch of the calling station upon being actuated operating the corresponding relay or relays to

connect the proper meter to the metering circuit.

In order to prevent a calling party from lighting the line lamp in the case of manual working or seizing the first selector in the case of automatic working, the circuit for the lamp, or the starter wire, may be arranged so that the line relay merely prepares a circuit for the line lamp or starter wire as the case may be, this circuit being closed only when the meter switching relay set pertaining to the station calling is actuated by the operation of the manual switch thereat. Thus the meter must be connected to the metering circuit before a call will be indicated before an operator or the calling line extended by an automatic switch.

Referring to the drawing which shows only so much of a telephone exchange system as is necessary for a comprehension of the invention, the substations are designated A, B, C and D. These stations are connected with the central office by line conductors 1, 2, which terminate thereat in a spring jack J, and in the usual line and cut-off relays 3 and 4 respectively.

The invention will be most readily understood from a detailed description of the operations involved in setting up a call. When the subscriber at station A removes his receiver from its switchhook, the following circuit is closed to energize line relay 3; free pole of battery, right winding of relay 3, inner armature and back contact of cut-off relay 4, line conductor 2, the substation apparatus, line conductor 1, outer armature of cut-off relay 4, left winding of line relay 3 to ground. Relay 3, in attracting its inner left armature, connects relays 7 and 8 to the lower talking conductor 2, and in attracting its outer left armature, connects relays 9 and 10 to the upper talking conductor 1. The subscriber at substation A now closes key 11 to its alternate contact, thus grounding the upper talking conductor 1 through a resistance 12. The closure of this circuit causes relay 9 to operate, but relay 10 being marginal, remains inert. Relay 9, in attracting its left armature removes itself and relay 10 from further control of the calling subscriber by opening contact 46, and locks itself to ground at the inner right armature of relay 3 over the following circuit: free pole of battery, relay 9, its left armature and front contact, conductor 14, inner left

armature and back contact of relay 10, conductors 15, 16, to ground at the inner right armature of relay 3. Relay 9 in attracting its inner right armature, connects the meter 13, individual to the substation A, to the test conductor 17, which terminates in the sleeve 18 of the spring jack J individual to the calling line. In attracting its outer armature, relay 9 closes the circuit of relay 19 which was prepared upon the closure of the outer right armature of line relay 3. Relay 19 in attracting its armature, lights the calling lamp 20 over a circuit including the armature and back contact of relay 21. The operator, in response to the lighting of the lamp 20, inserts the plug of the cord circuit, the answering end only of which is shown, into the jack J of the calling line, whereupon the relay 21 is operated over the following circuit: free pole of battery, resistance 22, sleeve of the jack, sleeve of the plug, cut-off relay 21, to ground. The cut-off relay 4 of the calling line is also operated in parallel with relay 21 to cut off line relay 3 from the calling line. Relay 9, however, is not deenergized by the operation of cut-off relay 4, since relay 4 in attracting its armature, provides a substitute locking circuit for relay 9 over conductor 45. Relay 21 in operating, extinguishes the lamp 20. The operator then depresses the listening key 23 and inquires the number of the line wanted. Although the insertion of the plug in the jack by the operator in answering the call, closes a circuit for the meter 13 in parallel with the cut-off relay 4, the meter magnet is marginal and does not operate upon the closure of this circuit. When, however, the operator after having set up the connection, depresses metering key 24, an increased current flows from a metering battery 25, which is effective to operate the meter 13 to charge the call.

The breaking down of the connection by the operator removing the plug from the jack J, deenergizes relays 21 and 4. The former closes at one point the circuit of lamp 20 in preparation for the next call, and the latter unlocks relay 9 to restore the meter switching relay circuit to normal condition. Relay 19 became deenergized by the retraction of the outer right armature of line relay 3.

Assuming that the call had been initiated by the subscriber at substation B, the closure of key 26 thereat to its alternate contact places a dead ground on the upper talking conductor 1, instead of grounding the same through a resistance. The marginal relay 10 in this case becomes energized in addition to the relay 9. Relay 10, in attracting its outer left armature and opening contact 47, removes itself and relay 9 from control of the calling subscriber and in attracting its inner left armature, locks itself in circuit

with relay 9 over the following circuit to the inner right armature of line relay 3: free pole of battery, relay 9, its left armature and front contact, conductor 14, inner left armature of relay 10 and its front contact, winding of relay 10, its outer left armature and front contact, conductors 15 and 16, inner right armature and front contact of relay 3 to ground. The attraction of the inner right armature of relay 9 and the right armature of relay 10, connects the meter 29 individual to substation B to the test wire 17, and the attraction of the outer right armature of relay 9 causes the energization of relay 19 and consequently lamp 20, whereupon the operator plugs in to answer the call. The remaining operations are the same as those described except that when the operator depresses the metering key 24 after the connection is established, the meter 29 is operated to advance the counting train to charge the call. The meter 13, individual to substation A, is not operated since its circuit is open at this time at the back contact and right armature of relay 10.

Assuming that the call had been initiated by the subscriber at substation C, the lower talking conductor 2 would have been grounded upon the actuation of key 30 by the calling subscriber through a resistance 31, causing the closure of the following circuit: ground, resistance 31, key 30, lower talking conductor 2, inner armature and back contact of cut-off relay 4, inner left armature and front contact of line relay 3, relays 8 and 7 to free pole of battery. The current in this circuit is insufficient to operate relay 8 which is marginal but is sufficient to operate relay 7. Relay 7, in attracting its left armature, disconnects itself and relay 8 from the lower talking conductor and connects itself directly to ground at the inner right armature of relay 3, over the following circuit: free pole of battery, relay 7, its left armature and front contact, inner left armature and back contact of relay 8, inner right armature of relay 3 to ground. In attracting its outer right armature, relay 7 connects relay 19 to the grounded outer right armature of line relay 3. Relay 19, in attracting its armature, lights the lamp 20 to indicate to the operator the arrival of the call. Relay 7, in attracting its inner right armature connects meter 37 to the third conductor 17. The operator now plugs in as before. Upon the establishment of the connection and the depression of the metering key 24 by the operator, the meter 37 is operated over the following circuit: metering battery 25, key 24, sleeve of the plug, sleeve of the jack, conductor 17, conductor 38, inner right armature and back contact of relay 9, inner right armature and front contact of relay 7, right armature and back contact of relay 8, meter 37, to ground.

Assuming that the subscriber at substation D had initiated the call, the closure of key 39 to its alternate contact places a dead ground on the lower talking conductor whereupon both relays 8 and 7 are operated. Relay 8, in attracting its outer left armature, locks itself to the inner right armature of relay 3 over the following circuit: free pole of battery, relay 7, its left armature and front contact, inner left armature and front contact of relay 8, winding of relay 8, outer left armature of relay 8 and its front contact, conductors 36, 16, to grounded inner right armature of relay 3. Relays 7 and 8 connect meter 41 to the test conductor 17. Upon the establishment of the connection and the depression of metering key 24, the following circuit is closed to operate the meter 41: metering battery 25, key 24, sleeve of the plug, sleeve of the jack, conductors 17 and 38, inner right armature and back contact of relay 9, inner right armature and front contact of relay 7, right armature and front contact of relay 8, meter 41, to ground.

The function of the resistance 5 at the substations is to maintain the line relay 3 energized when its initial energizing circuit including the transmitter is opened when the keys are operated. The resistance 5 is of sufficient value to maintain the line relay operated while the key 11 is closed to its alternate contact and also is high enough in value so that it will not interfere with the operation of the meter switching relays.

The left armature of relay 9 is arranged so that when relays 9 and 10 are operated, due to a dead ground on the upper talking conductor, this armature does not close its front contact before the inner left armature of relay 10 opens its back contact. Otherwise relay 10 would be short circuited. The corresponding armatures of relays 7 and 8 are similarly adjusted.

What is claimed is:

1. In a telephone system, a party line, stations thereon, a meter for each station at the central office, a metering circuit, a line relay at the central office, a circuit therefor including both sides of the party line in series closed by the removal of the receiver at the calling station, a manual switch at each station independent of the receiver hook, a set of meter switching relays at the central office jointly controlled by the manual switch of the calling station and said line relay to connect the meter of the calling station to

the metering circuit, and means for closing said metering circuit.

2. In a telephone system, a party line, stations thereon, a meter for each station at the central office, a metering circuit, a pair of meter switching relays, one of said relays being marginal, a circuit for said relays, a line relay at the central office operated by the removal of the receiver at the calling station and connecting said meter switching relays to one side of the calling line, manual switches at the stations for closing said meter switching relay circuit directly to ground or through a resistance to ground, depending on the station calling, to cause said relays to connect the meter of the calling station to the metering circuit, and means for subsequently closing said circuit.

3. In a telephone system, a party line, stations thereon, a meter for each station at the central office, a metering circuit, two pairs of meter switching relays, one of each pair being marginal, a circuit for each pair of relays, a line relay at the central office operated by the removal of the receiver at the calling station and connecting one pair of said meter switching relays to each side of the calling line, manual switches at the stations for grounding the corresponding side of the line directly or through a resistance to control the corresponding pair of meter switching relays to connect the meter of the calling station to the metering circuit, and means for subsequently closing said circuit.

4. In a telephone system, a party line, stations thereon, a meter for each station at the central office, a metering circuit, a pair of meter switching relays, one of said relays being marginal, a circuit for said relays, a line relay at the central office operated by the removal of the receiver at the calling station and connecting said meter switching relays to one side of the calling line, a line lamp, manual switches at the stations for closing said meter switching relay circuit directly to ground or to ground through a resistance, depending on the station calling, to cause said relays to connect the meter of the calling station to the metering circuit, a circuit for said line lamp closed upon the operation of said meter switching relays, and a key controlled by the operator for subsequently closing said metering circuit.

In witness whereof, I hereunto subscribe my name this 17th day of November A. D., 1919.

JOHN A. HALL.