

G. D. WOLF.
TELEPHONE SYSTEM WITH SERVICE METERS.
APPLICATION FILED MAY 21, 1914.

1,175,396.

Patented Mar. 14, 1916.

3 SHEETS—SHEET 1.

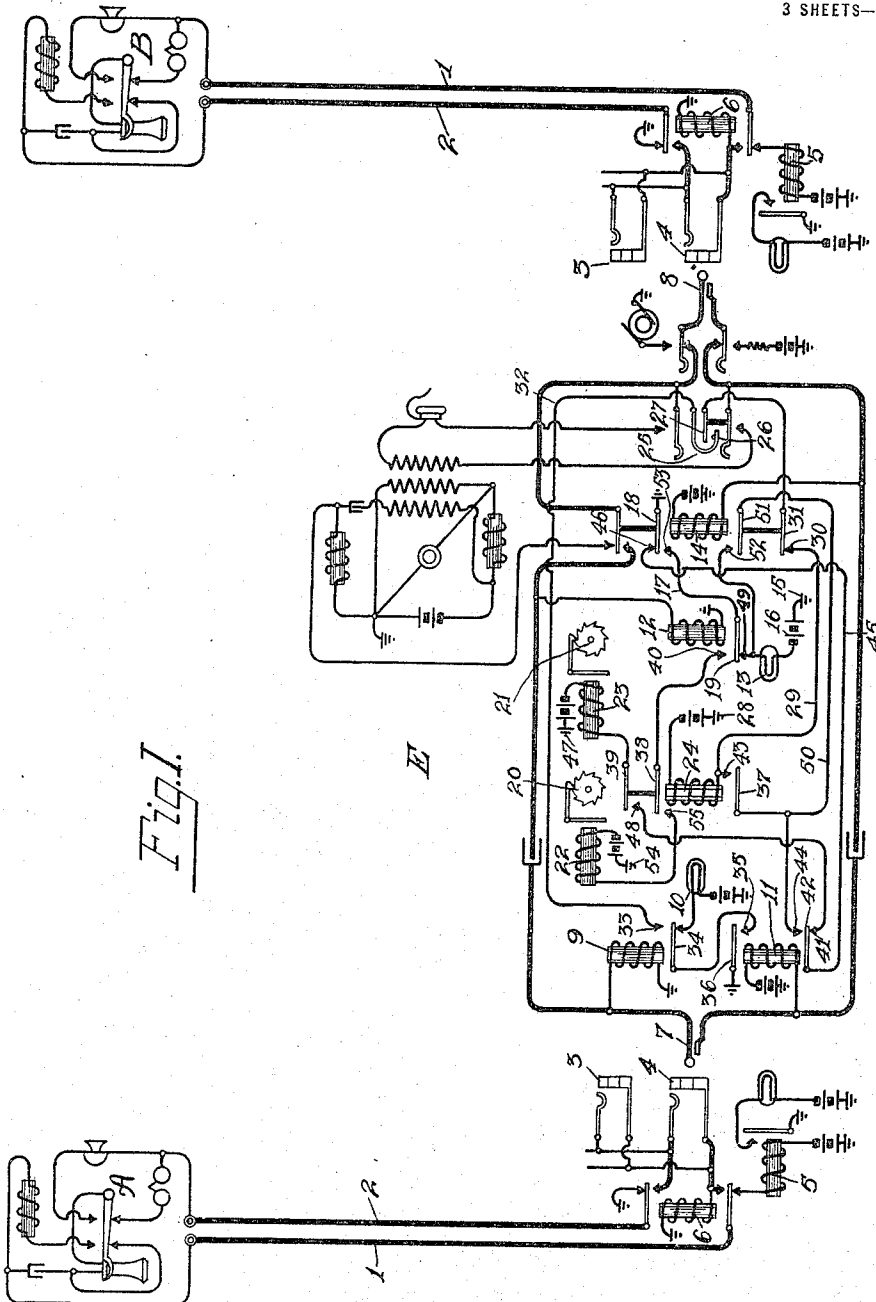


Fig. 1.

Witnesses:

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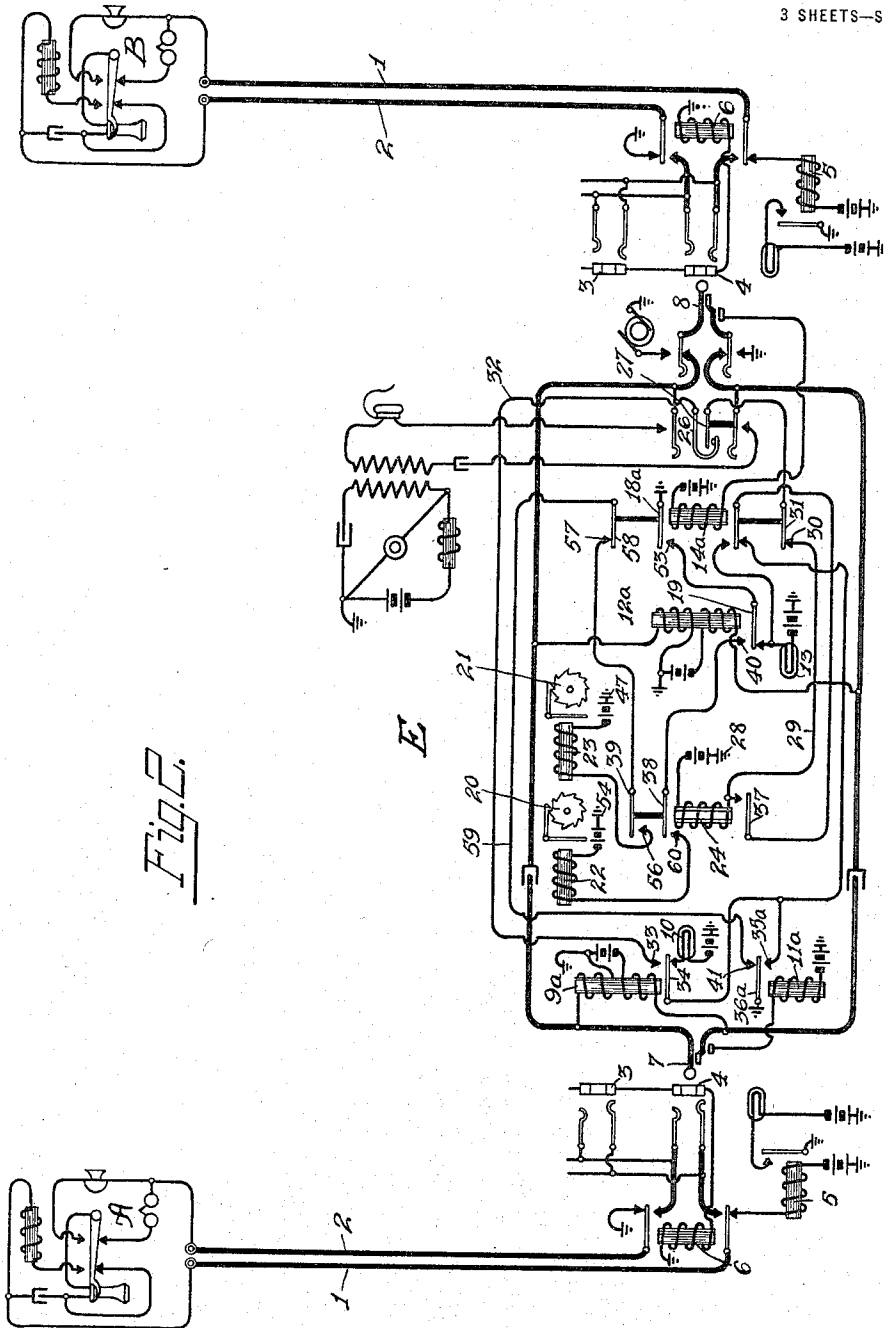


Fig. 2.

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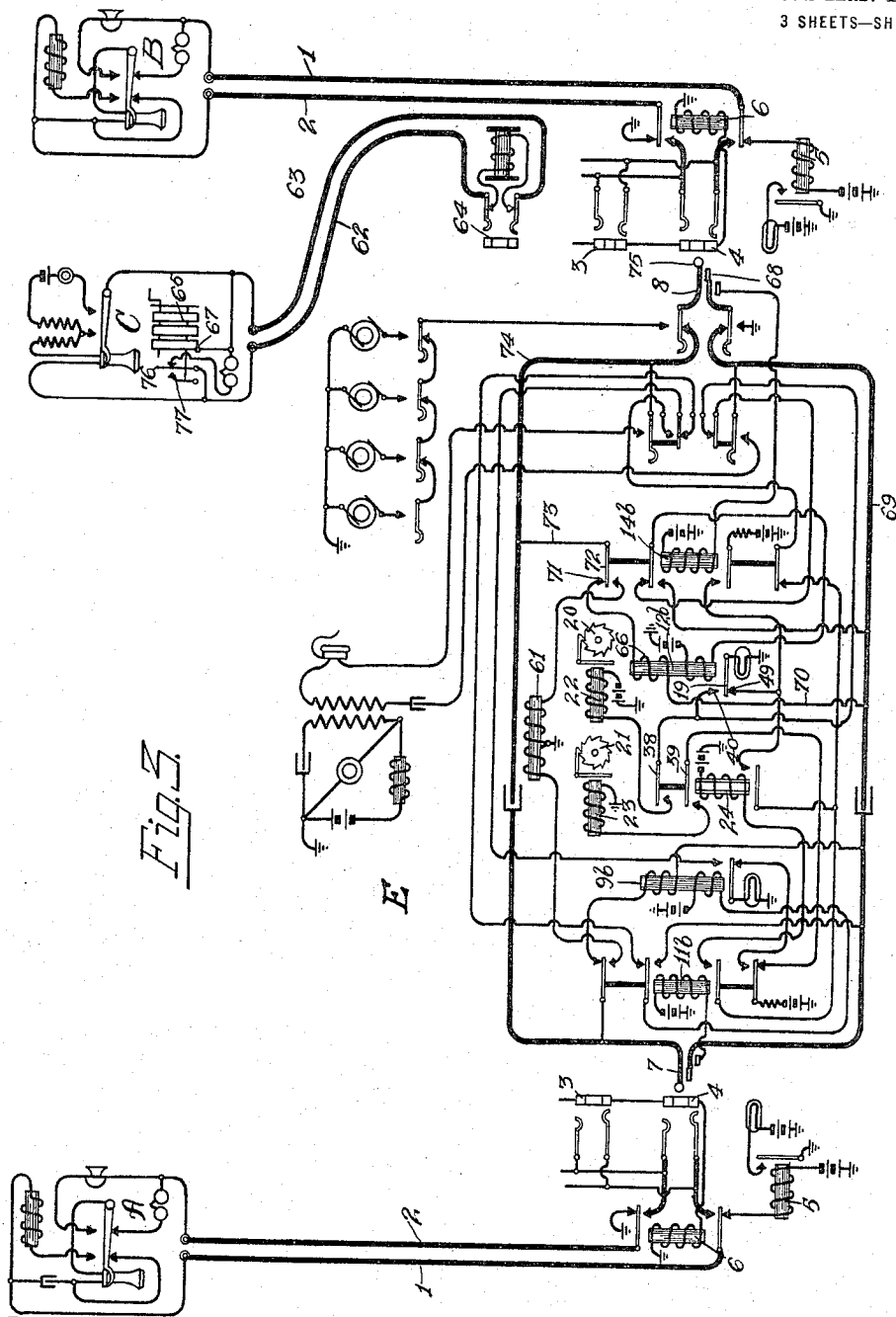


Fig. 3.

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM WITH SERVICE-METERS.

1,175,396.

Specification of Letters Patent.

Patented Mar. 14, 1916.

Application filed May 21, 1914. Serial No. 840,018.

To all whom it may concern:

Be it known that I, GEORGE D. WOLF, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems with Service-Meters, of which the following is a specification.

My invention relates to telephone systems with service meters and is more particularly designed to provide a system in which two meters are provided for each operator's position, one meter registering all of the completed calls made in that position and the other meter registering all uncompleted calls. The uncompleted call meter in the particular embodiment of the invention as shown herein registers all of the attempted and uncompleted connections except those where the called subscriber answers and these latter are registered on the completed call meter only.

In the particular form of the invention as herein disclosed I utilize a slow acting relay which places, whenever a call is answered, both the uncompleted call and the completed call meters in circuit relationship with other apparatus so that one or the other of these meters may be operated depending upon whether the called subscriber answers or whether the call is not completed.

In the accompanying drawings illustrating several applications of my invention, Figure 1 represents a diagrammatic view of a common battery telephone system having a two conductor cord circuit equipped in accordance with my invention; Fig. 2 is a view similar to that of Fig. 1 showing my invention as applied to a three conductor cord circuit, and Fig. 3 is a view similar to that of Fig. 1 showing my invention as applicable for combination common battery and magneto lines.

Referring more particularly to Fig. 1, I show two substations A and B united respectively by means of conductors 1 and 2 with a common battery exchange E. The substation instruments at the substations A and B may have any of the well known forms of battery equipment, one applicable form being illustrated herein which will be readily intelligible. The lines terminate in jacks 3 and 4 having the customary line relay 5 and cut off relay 6.

The novel features of the system are those

in connection with the cord or link circuit. The cord circuit herein has the answering plug 7 and the calling plug 8. Answering clearing out relay 9 controls the answering clearing out lamp 10 in connection with the sleeve relay 11. Whenever the plug 7 is inserted, the circuit through the sleeve relay 11 is completed through the cut off relay 6, thus placing the lamp 10 in condition to be controlled by the calling relay 9. Similarly the calling clearing out relay 12 connected between the ground and the tip strand on the calling side controls the calling clearing out lamp 13 in connection with the sleeve relay 14. The sleeve relay is actuated whenever the calling plug 8 is inserted in the jack by the completed connection through the cut out relay 6 of the line leading to the substation B. Thus whenever the relay 14 is energized as when the plug 8 is inserted but the called subscriber has not yet answered, then the circuit through the clearing out lamp 13 is completed from ground at 15, through battery 16, lamp 13, conductor 17, armature 18 of the relay 14 to ground. Whenever the supervisory relay 12 is then energized its armature 19 breaks the circuit through the lamp 13.

The novel features of my invention consist in the addition of the completed call meter 20 and uncompleted call meter 21 to this cord circuit for registration purposes. A magnet 22 controls the actuations of the meter 20 and the magnet 23 controls the actuations of the meter 21. Both of these magnets are initially placed in a receptive condition by the slow acting relay 24. Whenever the plug 7 is inserted in the jack 4 as when answering a call then relays 9 and 11 are energized. Thereupon the operator actuates her listening key 25, closing circuit between springs 26 and 27, thus establishing a circuit which may be traced from the ground at 28 through battery, through the slow acting relay 24, conductor 29, back contact 30, armature 31 of the relay 14, spring 27, spring 26, conductor 32, front contact 33, armature 34, of the relay 9, front contact 35, armature 36 of the relay 11, to ground, thus energizing the slow acting relay 24 and causing it to attract all three of its armatures respectively 37, 38 and 39. The attraction of the armature 38 completes the circuit of the magnet 22 of the completed call meter to the front contact 40 of the relay 12, and at-

traction of armature 39 extends the circuit of the magnet 23 of the uncompleted call meter to the back contact 41 of the armature 42 of the relay 11. At the same time the attraction of the armature 37 establishes a circuit which can be traced from the ground at 28 through battery, through slow acting relay 24, front contact 43, armature 37, front contact 44, armature 42, conductor 45, back contact 46, armature 18, to ground so that the relay 24 is thus locked in energized condition.

Now should the operator in calling find that the called for line B is busy, then the plug 8 is not inserted in the jack but the plug 7 is withdrawn from the jack of the calling party. Withdrawal of the plug 7 releases the armature 42, which thereby establishes a circuit from the ground at 47 through battery, through magnet 23, armature 39, front contact 48, back contact 41, armature 42, conductor 45, back contact 46, armature 18 to ground, thus causing the magnet 23 to operate the meter one stroke. Of course, the release of the armature 42 also breaks the circuit through the relay 24, but relay 24 being slow acting, its armatures are not released until after the circuit through the magnet 23 has been completed. In case the called for line is not busy, the calling plug 8 is inserted in the jack, thereby operating the calling sleeve relay 14. This operation switches the control of the slow release relay 24 from the make contact 44 of the answering sleeve relay 11 to the break contact 49 of the calling supervisory relay 12, thus keeping the slow acting relay 24 attracted through the circuit which may be traced from the ground at 28, through battery, through relay 24, contact 43, armature 37, conductor 50, armature 51, front contact 52, contact 49, armature 19, front contact 53, armature 18 to ground. At the same time the circuit is open to the uncompleted call meter to prevent operation in case the answering plug is removed, this occurring by the break between the contact elements 18 and 46. At the same time the circuit from the slow release relay through the listening key and answering supervisory relay is opened by the relay 14, by the breaking of the circuit through the contact elements 30 and 31 so as to permit the release of the slow acting relay 24 should the call be completed. When the called party answers the relay 12 operates, thereby completing the circuit through the magnet 22, which can be traced from the ground at 54, through battery, through magnet 22, front contact 55, armature 38, front contact 40, armature 19, front contact 53, armature 18, to ground, thus registering a completed call upon the meter 20 and at the same time breaking the circuit through the slow acting relay 24 at the contact elements 19 and 49. This again dis-

nects the meters from the cord circuit preventing any further registration of calls until the calling plug is removed and the listening key again operated upon a subsequent use of the cord for a further connection.

It will of course be understood that the meters 20 and 21 are common to a position and also that the various batteries shown are merely shown as separate batteries to avoid confusion as these batteries are intended to be the representation for one common battery which will be quite obvious. In case the called subscriber does not answer, then the slow release relay remains locked up until both plugs are removed, at which time the circuit through the uncompleted call meter magnet 23 is established between the contact elements 41 and 42 and an uncompleted call registered before the slow release relay is deenergized. As will be readily apparent the uncompleted call is registered no matter which plug is first removed since the circuit of the magnet 23 is not established, nor the locking circuit of the slow release relay interrupted until both relays 11 and 14 are in their deenergized positions.

By referring more particularly to Fig. 2, the system is shown as applied to a three conductor cord circuit. The meters 20 and 21 are again controlled through the agency of the slow acting relay 24 and its armatures 38 and 39. Upon closing the listening key a circuit is established from the ground at 28, through battery, through relay 24, conductor 29, back contact 30, armature 31, spring 27, spring 26, conductor 32, the front contact 33, armature 34, front contact 35^a, armature 36^a to ground. When the relay 11^a is deenergized the circuit from the uncompleted call meter can be traced (if the call is not completed) from the ground at 47, through battery, through magnet 23, contact 56, armature 39, back contact 57, armature 58, conductor 59, back contact 41, armature 36^a, to ground. Actuation of the calling sleeve relay 14^a without energization of the calling supervisory relay 12^a does not cause a registration on the completed call meter, but still permits a registration on the uncompleted call meter when the plug 7 is withdrawn, under similar conditions to those explained in connection with Fig. 1. Now should the call be completed however in the system as shown in Fig. 2, then a circuit is established through the magnet 22, which can be traced from the ground at 54, through battery, magnet 22, front contact 60, armature 38, front contact 40, armature 19, front contact 53, armature 18^a to ground, at the same time breaking the circuit through the slow acting relay 24 similarly to the manner described in connection with Fig. 1.

The circuit shown in Fig. 3, is, so far as essentials of this system are concerned, simi-

lar to the systems shown and described in Figs. 1 and 2, the cord circuit however being adapted for a common battery to magneto connection. Answering and calling sleeve relays 11^b and 14^b are shown and answering supervisory and calling supervisory relays 9^b and 12^b respectively, and impedance coil 61 is provided interposed between the grounded terminal of the battery and the tip strand of the cord circuit. The operation in general is similar when a connection is made with the line circuit consisting of the line conductors 62 and 63 leading to the magneto substation C, with this exception that the relays 14^b and 12^b are not energized when the plug 8 is inserted in the jack 64. Consequently the insertion and withdrawal of the plug 8 will have no effect on the magnets 22, 23 or 24, and with the exception of the condition to be presently related an uncompleted call will be recorded on the meter 21 whenever the called magneto line is busy, or whenever the called magneto line subscriber does not respond. Even if the called magneto subscriber does respond and does not ring off an uncompleted call will be registered. However when the magneto substation as is required when a conversation is completed operates the generator 65 to signify a completed conversation, then a circuit is established through the coil 66, of the relay 12^b, which can be traced from the terminal 67 of the generator 65, through line conductor 63, sleeve contact 68, of the plug 8, sleeve conductor 69, conductor 70, coil 66, back contact 71, armature 72, conductor 73, tip strand 74, tip 75, conductor 62, spring 76, contact terminal 77, to the other terminal of the generator 65, thus energizing the relay 12^b. Thereupon the circuit is broken at the contact elements 49 and 19, thus deenergizing the relay 24, but before this relay 24 releases its armatures establishing a contact between the elements 19 and 40, thus registering a call upon the meter 20.

From what has been described the nature of my invention will be readily clear to those skilled in the art, and it will also be clear that changes and modifications can readily be made without departing from the spirit of my said invention.

Having however thus described several forms which my invention may take, what I claim as new and desire to secure by Letters Patent is:

1. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, and means controlled by the condition of a called line to control the selective actuation of said meter mechanism.

2. In a system of the character described

the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, means whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, and means associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection.

3. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanisms for independently registering both partial connections and completed connections, means whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, means associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and means associated with said cord circuit operable upon response of a called party to render said second aforesaid means ineffectual to register a partial connection.

4. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, means whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, means associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and means associated with said cord circuit operable upon response of a called party to render said second aforesaid means ineffectual to register a partial connection, and actuating said meter mechanism to register a completed connection.

5. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, means whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, means associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and means associated with said cord circuit operable upon the receipt of a disconnect impulse from a called line to register a completed connection.

6. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both par-

lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, a slow acting relay whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, a relay associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and means associated with said cord circuit operable upon response of a called party to render said second aforesaid relay ineffectual to register a partial connection, and actuating said meter mechanism to register a completed connection.

11. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, a slow acting relay whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, a relay associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and means associated with said cord circuit operable upon the receipt of a disconnect impulse from a called line to register a completed connection.

12. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, a slow acting relay whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, a relay associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and a relay associated with said cord circuit operable upon response of a called party to render said second aforesaid relay ineffectual to register a partial connection.

13. In a system of the character described 115
the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, a slow acting relay whereby said meter 120
mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, a relay associated with said cord circuit operable upon disconnection of said cord circuit to actuate said 125
meter mechanism to register a partial connection, and a relay associated with said cord circuit operable upon response of a called party to render said second aforesaid relay ineffectual to register a partial connection. 130

tion, and actuating said meter mechanism to register a completed connection.

14. In a system of the character described the combination with entering subscribers' lines, of a cord circuit having meter mechanism for independently registering both partial connections and completed connections, a slow acting relay whereby said meter mechanism is placed in condition for operation upon the connection of said cord circuit with a calling line, a relay associated with said cord circuit operable upon disconnection of said cord circuit to actuate said meter mechanism to register a partial connection, and a relay associated with said cord circuit operable upon the receipt of a disconnect impulse from a called line to register a completed connection.

15. A telephone system comprising a calling and a called line, a cord circuit for connecting said lines, a meter associated with said cord circuit for registering completed connections, a second meter for registering incompleted connections, and means for operating either of said meters, said means being controlled by the condition of the called subscriber's line.

16. In a telephone system, a plurality of subscriber's lines, cord circuits for completing connections between said lines, meter mechanism common to said cord circuits for registering both partial and completed connections, and means controlled by the condition of a called line to control the selective actuation of said meter mechanism.

17. A telephone system comprising subscribers' lines, a cord circuit for connecting said lines, a meter device associated with said cord circuit for registering completed connections, a second meter device for registering incompleted connections, and means for operating either of said meter devices, said means being controlled by the condition of the called subscriber's line.

18. A telephone system comprising subscribers' telephone lines, link circuits, meter mechanism associated with said link circuits for registering both completed and incompleted connections, and electromagnetic

means under subscriber control to control the selective actuation of said meter mechanism.

19. In a telephone system the combination of subscribers' telephone lines, of a cord circuit provided with meter mechanism for registering both partial connections and completed connections, means responsive to the connection of the operator's telephone to said cord circuit for placing said meters in condition to be operated, and means for controlling the selective actuation of said meter mechanism.

20. A telephone system comprising subscribers' lines, a cord circuit provided with a meter for registering completed connections and a meter for registering incompleted connections, means responsive to the connection of the cord circuit to said lines as calling lines for placing said meters in operative condition, and subscriber controlled means for selecting the meter to be operated.

21. A telephone system comprising a plurality of telephone lines, a cord circuit for completing connections between said lines, a pair of meter devices for registering completed and incompleted connections, and means controlled by the condition of a called connected line to control the selective actuation of said meter devices.

22. A telephone system comprising subscribers' lines, meter mechanism located at the central exchange for independently registering both partial connections and completed connections, means responsive to the connection of a calling one of said lines to a trunk circuit for placing said meter mechanism in condition for operation, and means controlled by the condition of a called one of said lines to control the selective actuation of said meter mechanism.

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

GEORGE D. WOLF.

Witnesses:

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