(No Model.) 2 Sheets—Sheet 1.

C. E. SCRIBNER.

TOLL COUNTER FOR TELEPHONE LINES.

No. 593,612. Patented Nov. 16, 1897.

Fig. 1

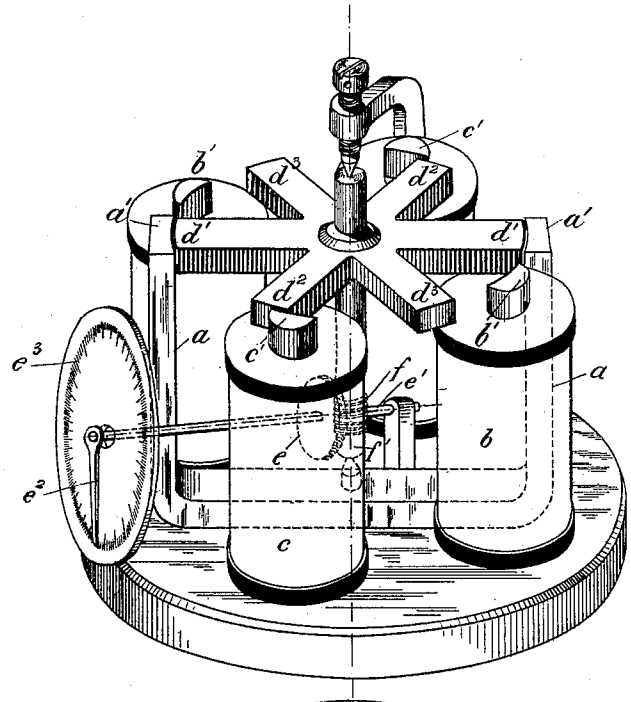
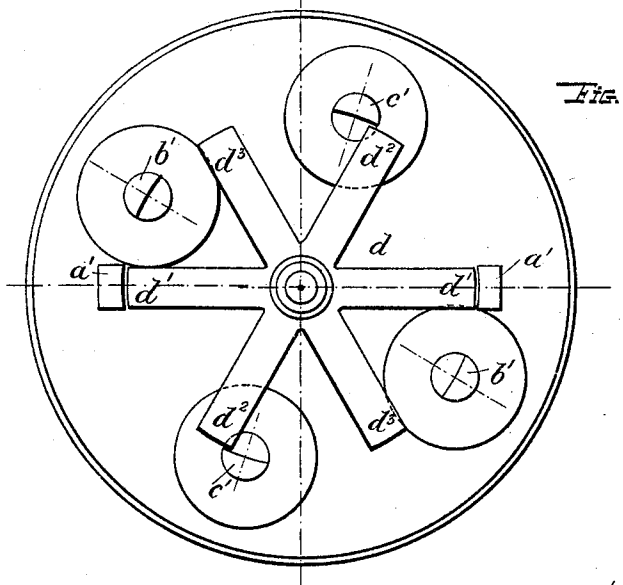


Fig. 2



WITNESSES:
George L. Cragg.
De Witt C. Tanner.

INVENTOR:
Charles E. Scribner
by: Burton Brown his Atty's

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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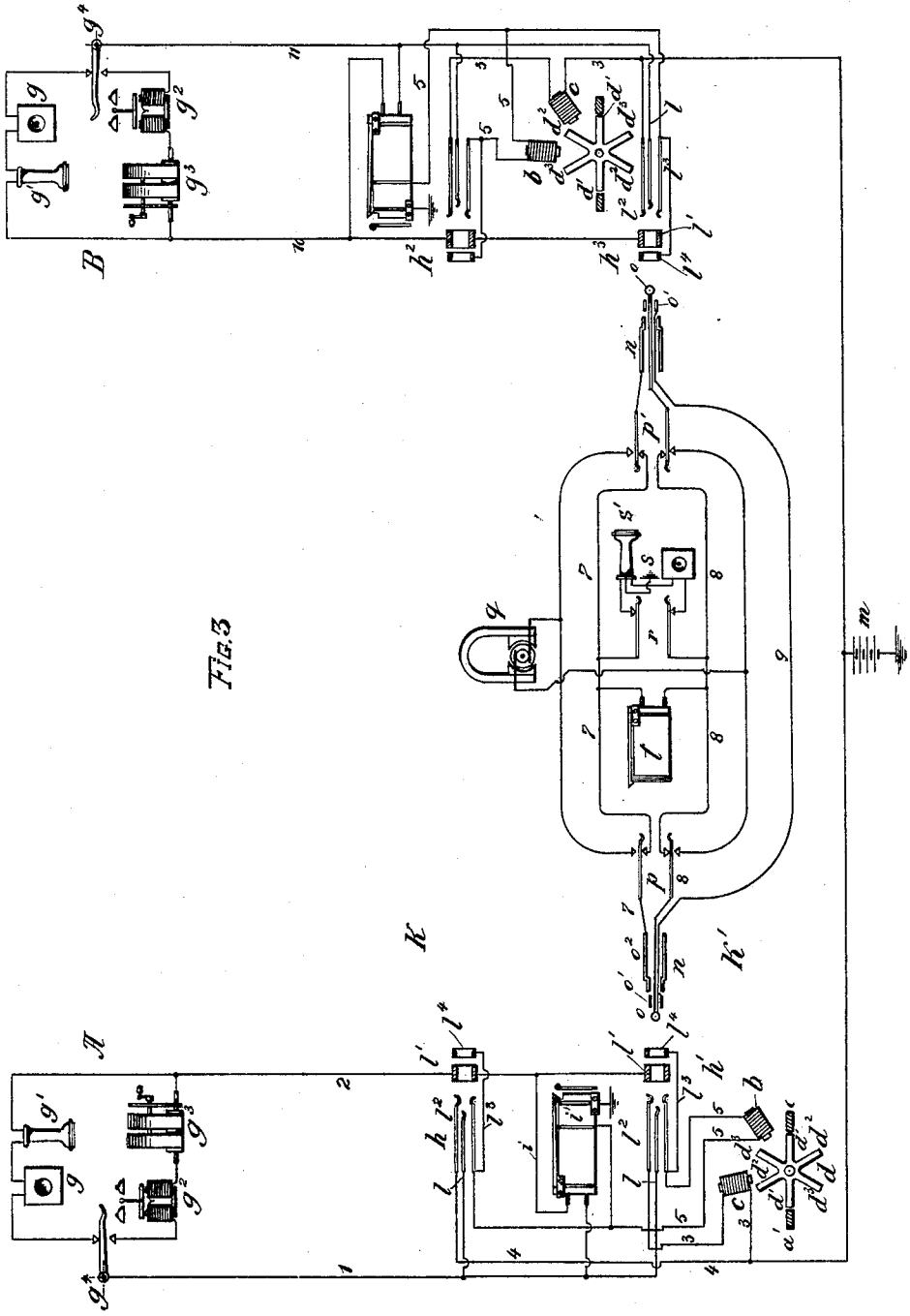


FIG. 3

WITNESSES:
George L. Cragg.
Dr. Walt C. Dawson.

INVENTOR:
Charles E. Scribner.
by: Baxter Brown his Atty's

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

TOLL-COUNTER FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 593,612, dated November 16, 1897.

Application filed September 10, 1894. Serial No. 522,608. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Toll-Counters for Telephone-Lines, (Case No. 360,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to apparatus for counting or registering the number or times of connections with a telephone-line. Heretofore various devices having this object in view have been designed, the immediate purpose of the device being to permit the charge of a fixed rate or toll for each use of the telephone-line, the generic name applied to the instrument being "toll-counter." Most commonly the toll-counter has been located at the substation of a telephone-line, the registration of the instrument being controlled either automatically in the use of some one of the telephonic appliances at the substation or manually by the subscriber. In the first case the instrument of course does not discriminate between the use of the telephone in communicating with the central station or its use in communicating with a correspondent after a completed connection with his line. In the latter case, the registration being optional with the subscriber, no satisfactory or certain basis for a charge or rental is secured. It is obviously desirable to so organize the toll-counter that it shall not take cognizance of incomplete connections, and, further, that it shall record only such completed connections as result in actual conversation between the connected subscribers, the charge being then purely for actual use of the telephone-line in conversation.

In my invention I have aimed to provide a toll-counter which may be located at the central station and which may automatically register completed connections between the call-initiating line and the line called for, and whose registration shall be under the control of the attendant making the connection. To this end I provide a toll-counter or registering instrument included in a local circuit in connection with the telephone-line at the exchange, and means for actuating the registering device through the instrumentality of the local circuits in the operation of establishing connection from the line provided with the register to another line by means of connecting-plugs in the usual manner, the final registration of the instrument being controlled or determined by the order of removal of the connecting-plugs from their sockets. To be more specific, I construct a registering instrument with two electromagnets, one of which is adapted to operate the recording mechanism and the other of which is arranged to undo the work of or neutralize the effect of the first electromagnet. These two magnets I arrange in different portions of a local circuit adapted to be closed in the act of making connection with the corresponding line in response to a signal therefrom, and in combination with the connecting-plugs and the spring-jacks of the lines with which connection may be made I arrange a series of conductors adapted to short-circuit or render inoperative the neutralizing or retracting magnet when connection is completed by means of the connecting-plugs. The apparatus being thus organized the establishment of connection with the call-initiating line and the completion of such connection with the answering-line do not effect any record or registration. The removal of the connecting-plug from the spring-jack of the answering-line then permits both magnets to be excited, whereby the retracting-magnet is caused to undo the work of the operating-magnet and thus to prevent the registration of a connection. The withdrawal of the answering-plug from the spring-jack of the call-initiating line, however, permits the mechanism actuated by the final deënergization of the main or operating magnet to effect registration, the retracting-magnet being deënergized. Thus, considering the different contingencies arising in the use of the telephone-line, it will be seen that the instrument can register only in the case of connections actually completed, and then only on condition that the operator, having ascertained that the call-initiating subscriber has actually entered into conversation with his correspondent, removes the answering-plug first. In all

other cases the instrument comes to rest in its normal position without having made any record of the use of the telephone-line.

I have devised a form of recorder or counter for use in connection with my invention which is peculiarly adapted to such use, being devoid of pawls and ratchets or actuating-springs and depending only upon varying magnetic attraction upon a rotating armature directly controlling the indicator or registering device. This recorder consists in two electromagnets and a permanent magnet adapted to operate simultaneously or successively upon a rotating armature. In the normal condition of the instrument the armature is held in a determined position by the attraction of the permanent magnet. When both electromagnets are simultaneously excited, the armature takes up a resultant position between the different magnets. If now one of the electromagnets be demagnetized, the armature is moved to a resultant position between the electromagnet and the permanent magnet, the mechanism being so constructed that in this position it is upon the point of making a record. If while the armature is in this position the previously-deenergized electromagnet be remagnetized, the armature will resume its earlier position, and when both electromagnets are subsequently simultaneously demagnetized the armature will return to its original position. If this be not done, the armature advances still farther to a new position, when the electromagnets are finally demagnetized and the registering mechanism is operated.

My invention is illustrated in the accompanying drawings, and may be described in a more complete and satisfactory manner in connection therewith.

Referring to the drawings, Figure 1 is a perspective view of my toll counting or recording instrument. Fig. 2 is a diagram showing the positions of the different magnet-poles with relation to the armature. Fig. 3 is a diagram of the circuit connections of my improved toll-counting system as a whole.

The toll-counter comprises, essentially, a permanent magnet a and two electromagnets b and c, whose poles are arranged about the periphery of a star-shaped armature d, which latter controls or actuates the recording mechanism. This recording mechanism may preferably consist simply of a gear-wheel e, meshing with a worm f upon a spindle f', carrying armature d. This worm-wheel e may be mounted upon a spindle e', carrying an indicator-arm e^2, moving over a dial e^3 in the usual way. The poles of the different magnets are placed, respectively, at diametrically opposite points of the circle about which they are arranged. The star normally takes up a position with two of its arms in a line between the poles a' a' of the permanent magnet a. The poles c' c' of magnet c are arranged slightly in advance of a pair of the remaining radial arms, while the poles b' b' of magnet b are arranged still farther in advance of the third set of arms. The adjustment of the poles b' b' with relation to the poles a' a' of the permanent magnet a is such that after the arms of the star d have placed themselves in a line joining the poles c' c' they are within the sphere of attraction of the poles a' to a greater extent than any other arms of the armature d and tend to move to poles a' a'.

As before stated, in its position of rest the armature d stands with two of its arms—say arms d' d'—in a line joining poles a' a'. If now magnets b and c be simultaneously excited by current in their coils, the arms d^2 and d^3 will be attracted toward poles c' c' and b' b', respectively, these electromagnets being constructed to overpower the attraction of the permanent magnet, and the arms mentioned will take up a resultant position between poles b' b' and c' c'. If at this point both magnets are simultaneously demagnetized, the arms d' d', being still within the range of attraction of poles a' a', will be drawn back to their former position. If, however, instead of both magnets becoming demagnetized only magnet c should be deënergized, the arms d^3 d^3 will move forward to take up a position in which they join the poles b' b'. Obviously if magnet b should now be reënergized the armature would take up its former resultant position; but if instead of this the magnet c be deprived of current the arms d^3 d^3, being within the range of poles a' a', will move forward into a line joining these poles, thereby having effected a movement of the star through one-sixth of a revolution, which movement will be indicated upon the dial e^3.

I will now proceed to describe my system of circuits for registering connections of lines extending to telephone-exchanges, of which the recording instrument just described is an element.

The apparatus provided for the telephone-line at the substation and that connected with the line upon the switchboard at the telephone-exchange may be the same as usual. In the drawings the substation apparatus—for example, at station A—is represented as comprising a microphone and telephone g and g', respectively, and a signal-bell and generator g^2 and g^3, together with an automatic telephone-switch g^4 for switching these instruments alternately into circuit with the line-wires 1 and 2. At the central station the lines 1 and 2 are connected with the line-contacts of spring-jacks h and h' and include the main magnet of a self-restoring individual annunciator i. The spring-jacks are assumed to be located on different sections k and k' of a multiple-switchboard, the annunciator i being upon the section k'. In addition to the line-contacts—the spring l and thimble l'—the spring-jacks h h' are provided with other springs l^2 and l^3, which constitute the normally-separated terminals of a local circuit which includes the resetting or restor-

ing magnet of the individual annunciator of the line together with the electromagnets of the corresponding toll-counter. The spring l^2 of the jack upon section k' with the line-annunciator i, which I shall designate the "answering-jack," is connected by conductor 3 through the magnet c of the toll-counter and through a battery m to earth. Spring l^2 of line-jack h is connected directly with the battery m by conductor 4. Local spring l^3 of the answering-jack h' is connected with conductor 5, which includes magnet b of the toll-counter, and is connected with restoring-magnet i' of annunciator i, whose other terminal is grounded. The spring l^3 of jack h is connected with conductor 5.

The operator at each switchboard is provided with the usual connecting-plugs united by flexible cords and with accessory keys and switching appliances. This apparatus is shown complete only at section k'. There it will be seen to comprise two connecting-plugs n n', each plug being constructed with three insulated contact-pieces as follows: A tip o, adapted to make contact with spring l, a short sleeve o', arranged to register with springs l^2 l^3, to cross them together and at the same time make circuit connection with them, and a long sleeve o^2, which is constructed to bear upon the thimble l' of the spring-jack. The like parts o, o', and o^2 of the two plugs of a pair are united by conductors 7, 8, and 9. The conductors 7 and 8 include the switch-contacts of two calling-keys p and p', either of which is adapted to disconnect the corresponding plug from its mate and to connect its terminals o o^2 with the poles of a generator q of signaling-current. An operator's listening-key r also has its switch-springs connected with conductors 7 and 8, its contact-anvils constituting the terminals of the operator's telephone set s. When the plunger of key r is depressed, the telephone is included in a bridge between conductors 7 and 8. The center of the coil of the telephone s' is grouded, as usual, for testing purposes. A clearing-out annunciator t for receiving the signal for disconnection is placed in a permanent bridge, uniting conductors 7 and 8.

I will now trace the operation of establishing connection between the two substations represented, following particularly the operation of the toll-counter in the use of the line.

Assume that subscriber at station A desires to communicate with subscriber at station B. The subscriber rotates his calling-generator g^3, the telephone g being upon the switch-hook g^4, whereby signaling-current is transmitted to the exchange, which operates the annunciator i and indicates the signal to the attendant at board k'. This operator then inserts a plug n into the answering-jack h' of the calling-line at her switchboard and depresses the plunger of her listening-key r. By this means the circuit of conductors 1 and 2 is extended, through the contact-pieces of the spring-jack and registering-contacts of plug n, to conductors 7 and 8, and thence to her telephone s', whereby she is enabled to communicate with subscriber at station A and to receive his order for the connection desired. By the insertion of plug n into jack h' the local springs l^2 l^3 are crossed together through the sleeve o', and the local circuit of battery m is completed, the circuit being through conductor 3, including magnet c of the toll-counter, to spring l^3, thence to spring l^3, through conductor 5, including magnet b and the restoring-coil i' of annunciator i, to earth. The individual annunciator is thus reset to its normal position, and at the same time the star-wheel d of the toll-counter is rotated through a small arc, taking up a resultant position between poles c' c' and b' b', as before described. Having received the order, the operator tests in the usual manner to determine whether the line called for is already in use or not—that is, by touching the test-ring l^4 of the jack h^3 of line to station B with the tip o of plug n'—it being understood that if the line be in use the test-ring l^4 will be electrified by connection with battery m, and the current derived therefrom will produce a click in telephone s'. If the line should be found busy, the operator would announce this to the call-initiating subscriber at station A and would withdraw the answering-plug n from answering-jack h'. Both magnets b and c of the toll-counter would thus be simultaneously demagnetized and the star-wheel d would return to its original position without having registered or counted the use of the telephone-line. If, however, the line called for be found free, the operator inserts the plug n' into the jack h^3, whereby the circuit between the two substations is completed, being extended from conductors 7 and 8 of the plug-circuit to line-wires 10 and 11 to station B. The operator then signals the subscriber at station B by depressing calling-key p', as usual. By the insertion of plug n' into spring-jack h^3 a short circuit is closed about the magnet c, this circuit being from spring l^3 of jack h^3 to the sleeve o' of plug n', thence through conductor 9 to the corresponding sleeve of plug n' thence to spring l^3 of the spring-jack h'. The magnet c thus loses its magnetization and allows the star-wheel d of the toll-counter to advance, as described. The operator has now placed the apparatus in position for communication between substations A and B, and, listening at her telephone s, she is enabled to determine whether conversation actually takes place between the subscribers. If subscriber at station B should fail to respond, the operator first withdraws plug n' from the spring-jack of the line to station B. The short circuit about magnet c is thus removed. This magnet becomes again energized and retracts the star-wheel to its second position. The operator then finally withdraws plug n from answering-jack h', whereby, both magnets b and c being simultaneously demagnetized, the star-wheel again returns to its

first position without having counted the use of the line. If, however, the operator, listening at her telephone, finds that the subscribers have entered into conversation with each other, she disconnects her telephone and proceeds with other business, as usual, until the signal for disconnection is displayed by clearing-out annunciator *t*. She then removes answering-plug *n* from answering-jack *h'* and afterward removes plug *n'* from the line-jack h^3. By the withdrawal of plug *n* first the magnet *b* is devitalized without the previous remagnetization of magnet *c*, and the star-wheel, under the attraction of permanent magnet *a*, moves from its third position, in which its arms d^3 join the poles *b' b'*, to a new position one-sixth of a revolution in advance of its initial position. This one-sixth of a revolution corresponds to one use of the telephone-line and is indicated upon the dial by the pointer moving over one division of the dial. The registration of the use of the telephone-line is thus made dependent upon the completion of the connection with the line of the subscriber called for and is placed under the control of the operator without requiring her to manipulate any additional apparatus, the registration being determined by the order of removal of the two connecting-plugs of a pair.

It is obvious that the mechanism of this device is not limited to this particular mode of operation. If desired, the discrimination between actual conversations and completed connections need not be made, in which case the operator has only to remove the answering-plug first in every instance. When operated in this manner, all completed connections will be recorded.

The utility of my improved counting device is of course not limited to its use in connection with this toll-counting system. It can be used with many forms of counters in which it is desired to avoid ratchet wheels and pawls.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a permanent magnet of an armature therefor having projections adapted to come successively into the field of the magnet, an electromagnet and means for intermittently exciting the same, and an armature for the electromagnet connected with the armature of the permanent magnet, the poles and armature of the electromagnet being so adjusted with relation to the poles and armature of the permanent magnet that the attraction of its armature by the electromagnet brings a new projection of the armature of the permanent magnet into the field of the latter, substantially as described.

2. The combination with a magnet having a permanent field, of an electromagnet and means for intermittently exciting the same, a common star-shaped revolving armature adapted to bring its arms successively into the permanent field, the electromagnet being adapted when excited to attract one of the said projections into such position that a new projection of the armature is within the permanent field, substantially as described.

3. The combination with a rotating star-shaped armature-controlling registering mechanism, of a permanent magnet adapted to attract an arm or projection of the armature to hold it in a stable position, and an electromagnet adapted to attract another arm of the armature, the said electromagnet being placed in position to bring a new arm of the armature into range of the permanent magnet, substantially as described.

4. The combination with a telephone-line and two appliances involved in making connection therewith adapted for successive operation, of registering or counting mechanism associated with the line and two electromagnets acting thereon, one adapted to cause it to register and the other adapted to return the registering mechanism to its prior position, circuits including the different magnets and switches controlling the circuits connected with the said appliances and operated in conjunction therewith, as described.

5. In combination, a magnet having a permanent field, two electromagnets and means for intermittently exciting them independently of each other, an armature having projections adapted to come successively into the permanent field, the said electromagnets being adapted when successively excited to bring a new projection into the permanent field, substantially as described.

6. The combination with a telephone-line, of two appliances, each adapted for making connection between the said line and another line, of a connection-counter associated with the said line, and mechanism actuated in the use of one only of said appliances controlling the operation of the counter; whereby connection may be made with the line without operating the counter thereof, as described.

7. The combination with a telephone-line, of two separate devices for making connection therewith, one designed for use in making connection from the line and the other for use in making connection to the line, toll counting or registering mechanism in connection with one of said devices, preferably the former, and means for determining the actuation of said mechanism when connection is made with the line, as described.

8. The combination with two telephone-lines, two sockets for each of the lines, and link conductors for uniting sockets of the different lines, of a connection-counter for each of the lines and actuating-circuits adapted to be closed through the counter of one line through the agency of the plug and one of the sockets of the same line; whereby the counter of one only of two connected lines is made operative during connection between lines.

9. The combination with two telephone-lines and means for uniting the lines in a through-circuit, of a connection-counter associated with one of the lines, actuated by an electromagnet, a circuit including the electromagnet, and means for completing it in the act of establishing a through connection between the two lines, an electromagnet adapted to return the connection-counter to its prior position, and means for exciting said last-mentioned electromagnet at will, as described.

10. The combination with two telephone-lines of a connection-counter comprising a registering device and means for actuating the same, an electromagnet adapted when excited to prevent the actuation of said registering device, and another electromagnet adapted when alone excited to cause its actuation, circuit connections and a switch adapted to permit the passage of current through both electromagnets when connection is made with one of the lines, and other circuit connections and a switch adapted to deprive said first-mentioned electromagnet of current when connection is completed with the other line, substantially as described.

11. The combination with a telephone-line, of an automatic switch adapted to be operated in the act of making connection with the line, a toll-counter comprising two electromagnets included in a local circuit controlled by the switch and registering mechanism controlled by them, said electromagnets being adapted when simultaneously excited to prevent the operation of the recording mechanism of the toll-counter, but one of them being adapted to actuate said mechanism when alone excited, and means for demagnetizing the other magnet to cause the instrument to register, substantially as described.

12. The combination with two telephone-lines terminating in a telephone-switchboard, of an answering-jack connected with one of the lines, a toll-counter in a normally open local circuit, said toll-counter comprising two electromagnets and recording mechanism controlled thereby adapted to be actuated only when one of the magnets is excited but not when both are simultaneously excited, switch-contacts for closing the circuit through both electromagnets when connection is made with the answering-jack, and switch-contacts actuated in establishing connection with the other line controlling the circuit of one of the magnets to deprive the magnet of current when such connection is made, substantially as described.

13. The combination with two telephone-lines and appliances for uniting them, said appliances being adapted for successive operation in the process of uniting the lines, of a connection-counter associated with one of the lines, devices actuated in the movement of said appliances and mechanism for operating the counter brought into action through the operation of said devices in a particular succession, substantially as described.

14. The combination with two telephone-lines connected to form a compound circuit extending between two substations through a central station; of a registering device associated with each; and means, substantially as indicated, for actuating the said registering device of the initiatory line, and for maintaining quiescent that of the called line.

15. The combination with two telephone-lines and link conductors for uniting the lines into a continuous telephonic circuit, of an electromagnetic connection-counter for one of the lines, and actuating-circuits including the electromagnet of said counter closed in switch-contacts at two points, one at the point of connection of each line with the said link-conductors; whereby the counter is made operative only when connection between the lines is completed.

16. The combination with telephone-lines, an answering-jack and a line-jack for each line, and plugs and a plug-circuit for making connection between the answering-jack of one line and the line-jack of the other, of an electromagnetic connection-counter for one of the lines, and a local battery-circuit including the magnet of said counter closed through registering contact-pieces of each spring-jack and the plug therein and a conductor uniting the plug-contacts, as described.

In witness whereof I hereunto subscribe my name this 16th day of June, A. D. 1894.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,

DUNCAN E. WILLETT.