Aug. 22, 1933. C. GILLINGS ET AL 1,923,668

TELEPHONE SYSTEM

Filed June 8, 1931 4 Sheets-Sheet 1

Fig. 1.

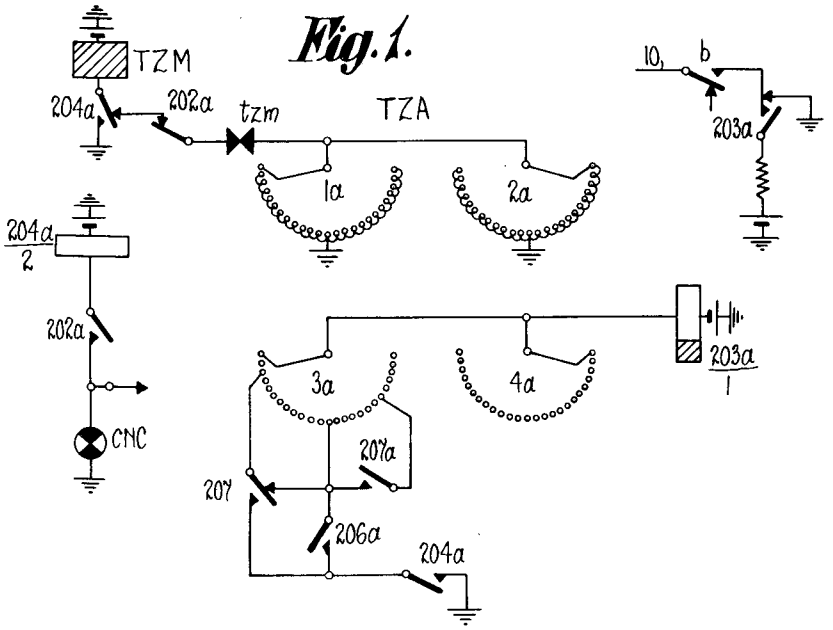
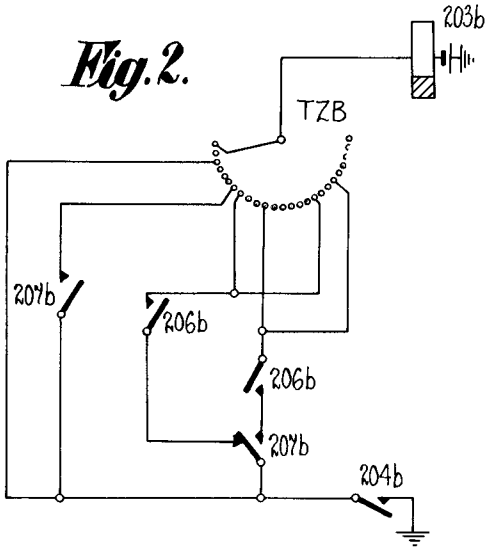


Fig. 2.



Inventors
Charles Gillings
Francis Tatlock Bates
Wm Walter Dawson
Atty.

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TELEPHONE SYSTEM

Filed June 8, 1931 4 Sheets-Sheet 2

Fig. 3.

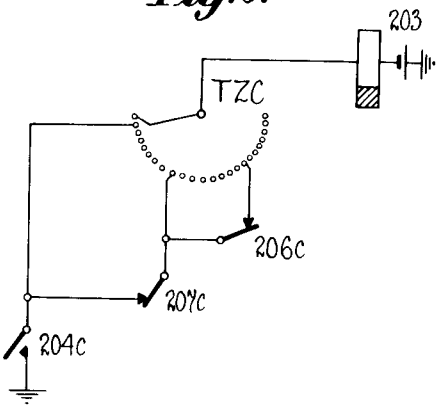
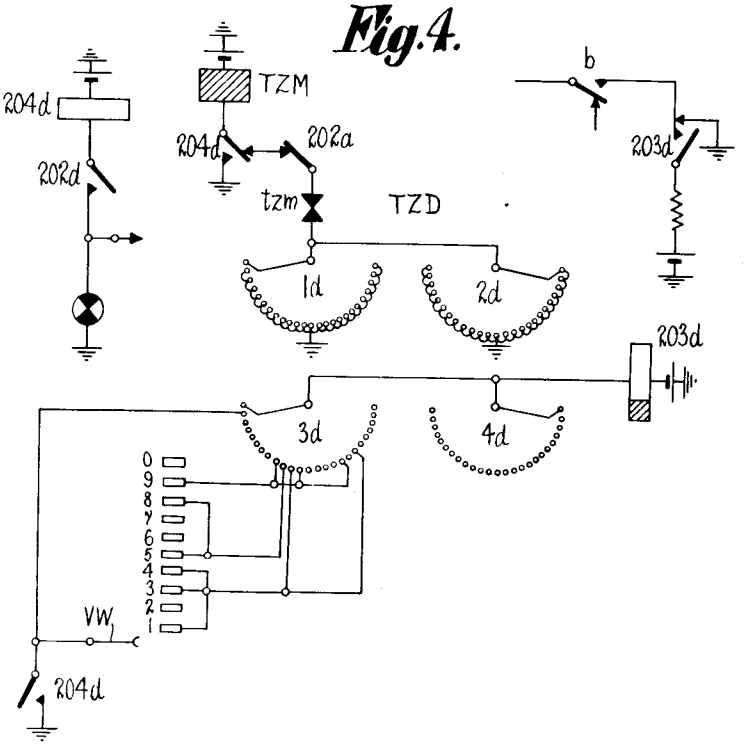


Fig. 4.



Inventors
Charles Gillings
Francis Tatlock Belas
Wm. Watts Crew
Atty.

Aug. 22, 1933. C. GILLINGS ET AL 1,923,668

TELEPHONE SYSTEM

Filed June 8, 1931 4 Sheets-Sheet 3

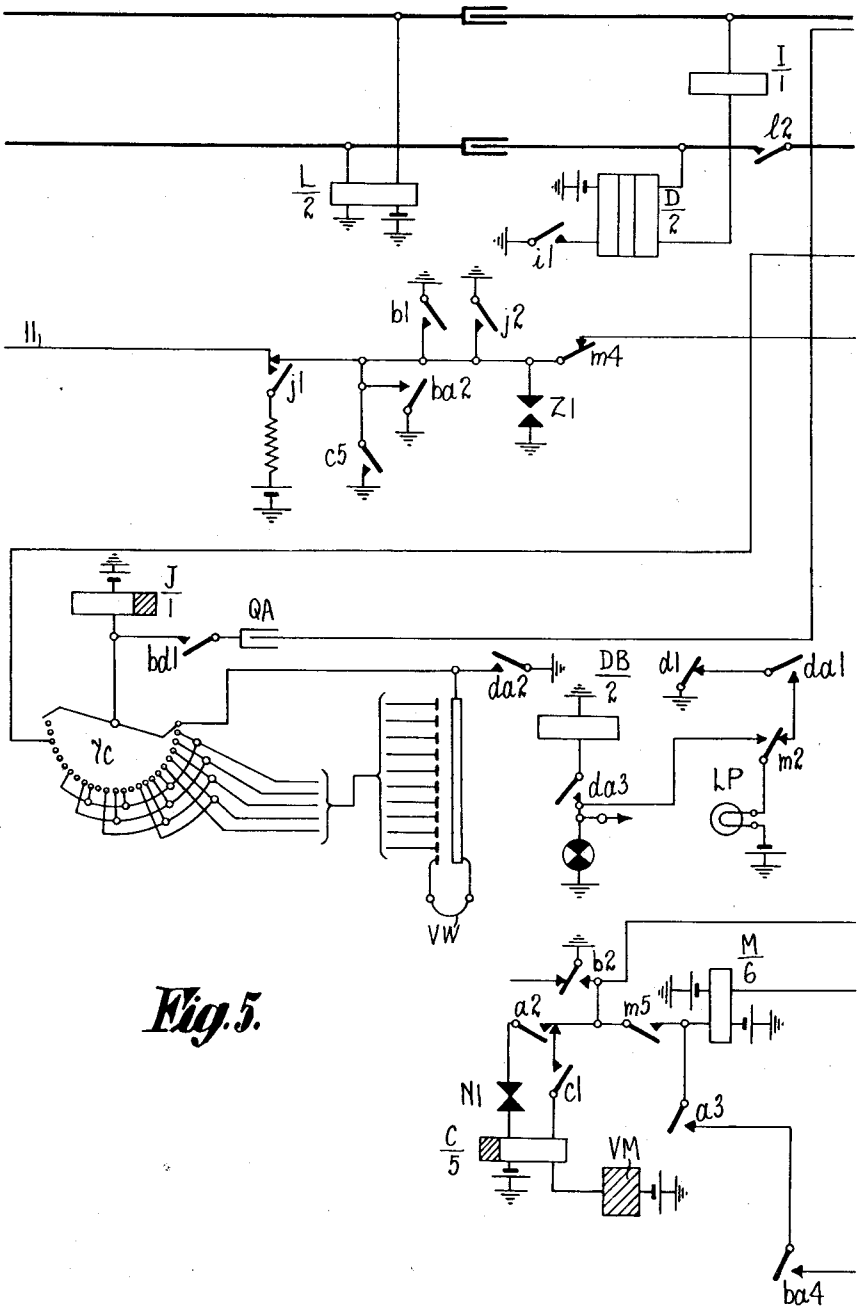


Fig. 5.

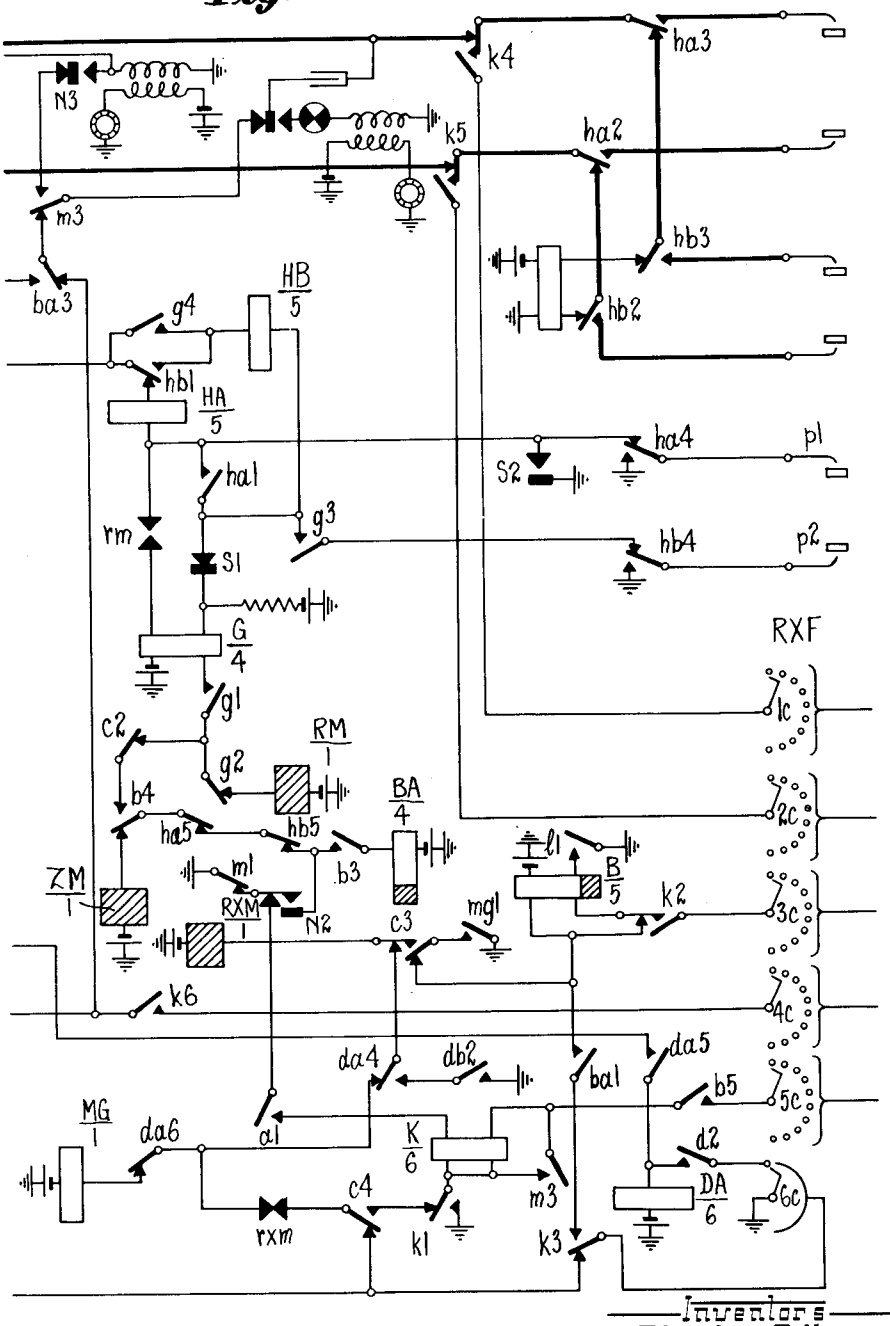
Inventors
Charles Gillings
Francis Tatlock Belas
Wm Wallace Brown
Atty.

Aug. 22, 1933. C. GILLINGS ET AL 1,923,668

TELEPHONE SYSTEM

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Fig. 6.



Inventors
Charles Gillings
Francis Tallock Belas
Wm. Walter Dowell.
Atty.

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Charles Gillings and Francis Tatlock Belas, Liverpool, England, assignors to Associated Telephone and Telegraph Company, Chicago, Ill., a Corporation of Delaware

Application June 8, 1931, Serial No. 542,714, and in Great Britain July 16, 1930

14 Claims. (Cl. 179—7.1)

The present invention relates to improvements in telephone systems and is more particularly concerned with zone metering arrangements for use in telephone systems in which subscribers are charged for a complete call in accordance with the zone to which they are connected and also for the length of their conversation.

According to one feature of the invention the number of metering impulses is arranged to be controlled by the continuous operation during the conversational period of a switch the bank of which is arranged to be variably marked in accordance with certain of the digits employed in setting up the connection.

According to another feature of the invention an impulse sender is adapted to be continuously operated during the conversational period to control metering and to be temporarily associated during the setting up of the connection with an impulse responder adapted to respond to digits employed in setting up the connection.

According to a further feature of the invention an auxiliary switch which is made use of during the setting up of the connection is adapted to be continuously operated during the conversational period to control the number of metering impulses.

According to a still further feature of the invention a non-numerical switch serving to connect a first numerical switch to a register controller is subsequently adapted to control the rate at which impulses are transmitted to the calling party's meter.

These and other features of the invention will be better understood from the following description of various methods of carrying it into effect, reference being had to the accompanying drawings comprising Figs. 1, 2, 3, 4, 5 and 6. Figs. 1, 2, 3 and 4 contain four schemes which are similar in function but are slightly different in the manner in which they are carried into effect. Figs. 5 and 6 show the application of the scheme in Fig. 4 to a first code selector switch in a code translating register controller system, and it should be mentioned that its application to this arrangement is particularly advantageous, since the hunting switch which is normally employed for the purpose of selecting a register controller may again be taken into use when the called party answers to serve the purpose of the time and zone metering switch as shown in Fig. 4. In order to facilitate the understanding of the invention it will be described as an improvement of that disclosed in United States Patent No. 1,738,931, issued Dec. 10, 1929 to R. F. Stehlik, and moreover certain of the references used are arranged to be similar to those employed in this patent, so that the relationship of various components which are not specifically illustrated and described will be readily understood when mention is made of these in the text.

Referring now particularly to the operation of the scheme shown in Fig. 1, it should be explained that the armatures 206*a* and 207*a* will be operated from relays bearing similar designations in accordance with the setting of a so-called zone marking switch in the manner described in the above-mentioned patent, thereupon preparing a marking circuit to the banks of the combined time and zone switch which has been conveniently designated TZA. When now the called party answers, the armature 202*a* will be operated from a relay similar to that shown in the patent referred to to connect up the impulsing relay 204*a* to the counting cam CNC, the speed of rotation of which may be varied to deliver impulses at different speeds in accordance with the time of the day. For instance, under certain circumstances the speed of the cam may be so regulated to deliver 25 impulses to relay 204*a* during the period of 60 seconds, while under other circumstances 25 impulses might be spread over a period of 120 seconds so as to provide a longer period between each impulse and consequently a longer metering cycle. Relay 204*a* in operating in accordance with the impulses from the counting cam will at armature 204*a* complete a circuit to the driving magnet TZM so as to rotate the wipers of the time and zone switch TZA step by step around the bank contacts. Armatures 206*a* and 207*a* being operated separately or together in the manner previously described will extend marking potential to the contacts of the bank 3*a* in various combinations, depending upon the zone connected with, and for each contact marked relay 203*a* will be operated during the rotation of the switch to apply booster battery in place of earth to the release trunk conductor 10 so as to effect the operation of the calling subscriber's meter in the well-known manner. Conveniently in the drawing a 50 point single motion switch is shown and it will be appreciated with the time periods previously quoted a metering cycle of from two to four minutes may be readily obtained by adjusting the speed of the counting cam. With the arrangements contemplated the metering counts will commence immediately the called party replies, while the number of counts per time cycle will vary in accordance with the zone connected with and possibly the time of the

day. At the end of the conversation the armatures 202*a* will be released in the manner described in the above-mentioned patent, whereupon relay 204*a* will fall away owing to the disconnection of the impulsing circuit, and at a further armature of relay 202*a* a self interrupted homing circuit is completed to the switch TZA so as to rotate the wipers into the home position.

The scheme shown in Fig. 2 shows a different method of marking the bank contacts of the time and zone metering switch and therefore only the marking bank has been shown in detail since the controlling means may be assumed to be identical with those shown in the scheme of Fig. 1. When neither of the armatures 206*b* or 207*b* are operated a single metering count will be made for zone 1 by way of the permanent bank marking which is always connected. With armatures 207*b* alone operating two metering counts will be made corresponding to zone 2. With armatures 206*b* alone operated, three metering counts will be made for zone 3 and finally when both sets of armatures are operated four metering counts will be made for zone 4. The homing and impulsing circuits are of course assumed to be identical with those shown in Fig. 1.

The scheme shown in Fig. 3 shows a still further arrangement of bank marking in which the sequence of operations is inverted, that is to say all circuits are normally connected and the operation of the respective armatures is arranged to produce a negative effect. Consequently armature 207*c* is operated to produce one metering count for zone 1, armature 206*c* is operated to produce two counts for zone 2, while neither armatures are operated to produce three counts in zone 3.

The scheme shown in Fig. 4 shows a slightly different arrangement from those previously described since the zone connected with is determined by the marking on a vertical bank shown and not in accordance with a two motion setting as contemplated in the above-mentioned patent previously referred to. In this scheme it will be seen that the bank contacts of the time and zone switch are connected together in groups of two's, three's, four's and so on, while these groups are in turn connected to the vertical bank contacts in accordance with the number of counts it is necessary to produce on the marking bank for the zone associated with the level chosen.

Referring now to the particular arrangement shown in Fig. 4, it will be seen that the vertical bank contacts 2, 6, 7 and 0 which are not connected to common groups of contacts will produce a single metering count corresponding to zone 1 since the vertical wiper VW is permanently connected to a single contact in the marking bank. Contacts 5 and 8 which are connected together produce a single marking in the bank of the time and zone switch which in addition to that permanently connected produces two counts corresponding to zone 2. Contacts 1, 3 and 4 are connected together so as to produce three counts for zone 3 while contact 9 extending to a common group of three contacts will produce four counts for zone 4. As already described when the called subscriber replies relay 202*d* will be operated in the manner described in the above-mentioned patent to connect up the stepping circuit to the time and zone switch, whereupon relay 203*d* which is connected to the marking bank wipers will be intermittently operated from the bank markings to extend booster battery over the release trunk conductor thereby effecting the operation of the calling subscriber's meter.

Referring now to Figs. 5 and 6, these show the application of the scheme shown in Fig. 4 to a first code selector of the type used in a system which employs a hunting switch to extend the calling line to a register controller of the code translating type. When the register controller has completed its sending operation, relay K, Fig. 6 will release to complete the speaking circuit and thereupon the hunting switch designated RXF will then return to its home position in a self interrupted circuit which may be traced from earth by way of the homing bank and wiper 6*c*, resting armatures *k*3 and *c*4, interrupter springs *rxm*, resting armature *da*4, resting contacts of armature *c*3, winding of driving magnet RXM to battery. In this manner the magnet will be intermittently energized to rotate the wipers of the switch RXF to their home position, and when this is reached the driving circuit from the homing bank will be opened, while a further circuit extending from the home bank contact will be prepared to relay DA which is operated from the polarized relay D, Fig. 5, when the called party answers. Relay DA in operating at armature *da*4 opens a point in the homing circuit to the hunting switch so that this shall not be effective during its subsequent rotation as time and zone switch. At armature *da*3, Fig. 5, relay DA which is equivalent to relay 204*d* shown in Fig. 4 will be operated, while at a further armature *da*2, Fig. 5, earth will be connected to the contact plate and the vertical wiper VU to effect the marking of the time and zone switch bank. Relay DB in impulsing at its armature *db*2 intermittently energizes the driving magnet RXM so as to advance the wipers of the switch RXF around its bank contacts, and it will be noticed that during this period all other wipers of the switch excepting that designated 7*c* will be disconnected so as not to interfere with the connections already set up. In order to indicate more clearly the bank marking arrangements for the bank 7*c* the full 25 contacts have been shown, and as in the arrangement of Fig. 4 the first contact is permanently marked so as to produce a single metering count for zone 1, while the other contacts are connected together in groups so that they may be cross-connected to the required vertical bank contacts in any desired combination as suggested by the bracketed connections. Consequently, as the switch is rotated step by step relay J which is connected to wiper 7*c*, will be intermittently operated from the bank marking a predetermined number of times depending upon the zone connected with and at its armature *j*1 substitutes booster battery to the release trunk conductor 11 in place of guarding earth so as to effect the operation of the calling subscriber's meter in the usual manner. It will also be noticed that at the end of each metering cycle a light tone conveniently derived in the present example by way of the usual number unobtainable feed will be extended by way of the low capacity condenser QA, operated armature *db*1, wiper 7*c* and bank contact, to the upper speaking conductor so as to inform the calling subscriber that one metering cycle is ended and that a further metering cycle will shortly commence. At the end of the conversation when the calling subscriber clears his connection, relay DA will release so as to disconnect the metering circuit, and at its resting armatures *da*4 and *da*6 again connects up the homing circuit to the switch RXF so that the wipers will be returned

to their home position in readiness for a further connection. It should be explained during the homing operation of the switch RXF, relay MG will be intermittently energized to complete a circuit to relay B which owing to its slug, is held continuously operated to guard the circuit until the switch reaches its home position.

We claim:

1. In a measured service telephone system wherein automatic switches are operated in accordance with dialled digits to set up and complete talking connections between subscribers' lines, a switch, a switch-bank and wipers for said switch, means for variably marking the switch bank of said switch in accordance with certain of the digits employed in setting up a connection, means for continuously operating the wipers of said switch during the talking period of an established connection to wipe over said switchbank, and means controlled by the operation of the wiper of said switch for transmitting a different number of metering impulses in accordance with each variable marking in said switchbank.

2. In a measured service telephone system wherein telephone connections between subscribers' lines are set up and completed by automatic switches controlled by an impulse responder operated in accordance with dialled digits, an impulse sender, means for temporarily associating said sender with said impulse responder during the setting up of a connection, means for continuously operating said sender during the talking period of an established connection, and means controlled by the operation of said sender for transmitting metering impulses.

3. In a measured service telephone system wherein automatic switches are operated to set up and complete talking connections between subscribers' lines located in different zones, an impulse sender associated with one of said automatic switches, said one automatic switch set in a position corresponding to the zone a called subscriber's line is located in, means for continuously operating said sender during the talking period of an established connection, and means controlled by the operation of said sender for transmitting a number of metering impulses in accordance with the setting of said associated switch.

4. In a measured service telephone system, subscribers' lines, means for setting up and completing a telephone connection between said lines, an auxiliary switch, means for temporarily operating said switch during the setting up of a connection, means for thereafter continuously operating said switch during the talking period of said connection, and means controlled by the operation of said switch for transmitting a number of metering impulses.

5. In a measured telephone system, subscribers' lines, means for completing a telephone connection between said lines, auxiliary controlling equipment for controlling said means, a non-numerical hunting switch operated responsive to the initiation of a call to connect said auxiliary controlling equipment to said means to enable said means to complete a connection, and means for subsequently operating said switch to control the number of metering impulses to be transmitted for the said completed connection.

6. In a measured service telephone system wherein series of numerical automatic switches are controlled by a register controller to complete a telephone connection between calling and called subscribers' lines, a non-numerical hunting switch operated responsive to a call on a calling line for connecting said register controller to the first numerical switch of a series of said switches in setting up a connection, a metering circuit for operating the calling subscriber's meter, and means for subsequently operating said non-numerical switch to control the rate at which said circuit is closed to transmit metering impulses to operate the calling subscriber's meter.

7. In a measured service telephone system wherein automatic switches are operated to set up and complete talking connections between subscribers' lines and wherein an impulse responder is set in accordance with digits dialled by a calling subscriber and is temporarily associated with said switches for controlling their operation, a switch, means for variably marking the bank of said switch in accordance with the variable setting of said impulse responder, means for continuously operating said switch during the talking period of an established connection, and means controlled by the operation of said switch for transmitting a different number of metering impulses in accordance with each variable marking in said switchbank.

8. In a measured service telephone system wherein automatic switches are operated in accordance with dialled digits to set up and complete talking connections between subscriber's lines, a switch including a switchbank and wiper therefor, contacts on one of said automatic switches included in the talking connection for variable marking the switchbank of said switch in accordance with the variable setting of said one automatic switch in setting up a connection, means for continuously operating the wiper of said switch during the talking period of an established connection to wipe over said switchbank, and means controlled by the operation of the wiper of said switch for transmitting a different number of metering impulses in accordance with each variable marking in said switchbank.

9. In a measured service telephone system wherein an impulse repeater responds to digits dialled by a calling subscribed to control and operate an impulse responder in accordance with such digits to subsequently control and operate automatic switches to set up and complete a talking connection between subscribers' lines, a switch permanently connected to said impulse repeater, means for variably marking the bank of said switch in accordance with certain of the digits to which the said repeater responds, means for continuously operating said switch during the talking period of an established connection, and means controlled by the operation of said switch for transmitting a different number of metering impulses in accordance with each variable marking in said switchbank.

10. In a measured service telephone system wherein automatic switches are operated in accordance with digits dialled by a calling subscriber to set up and complete talking connections between subscribers' lines, a switch permanently connected to one of said automatic switches included in the talking connnection, a switchbank and wipers for said switch, means for variably marking the switchbank of said switch in accordance with the digit used to set said one automatic switch, means for continuously operaating the wipers of said switch during the talking period of an established connection to wipe over said switchbank, and means controlled by the operation of the wipers of said switch for transmitting a different number of metering

impulses in accordance with each variable marking in said switchbank.

11. In a measured service telephone system wherein automatic switches are operated to set up and complete talking connections between subscribers' lines, an impulse sender associated with one of said automatic switches included in the talking connection, a metering circuit, a rotary switch including a wiper and bank contacts therefor in said sender, means for continuously operating said wiper over its bank contacts during the talking period of an established connection, a set of relays for variably marking the contacts in said switchbank to determine the number of metering impulses to be transmitted over said metering circuit, and a relay operated over said wiper and the marked contacts responsive to the operation of said wiper for transmitting metering impulses over said metering circuit in accordance with the variable marking of said bank contacts by said set of relays.

12. In a measured service telephone system wherein a series of numerical automatic switches are controlled by a register controller to set up and complete a talking connection between a calling and a called line, a non-numerical hunting switch operated responsive to a call on said calling line for connecting said register controller to the first numerical switch in said series, means for disconnecting said non-numerical switch from said register controller and for restoring said non-numerical switch to normal responsive to the selection of the called line, means responsive to the called party answering for reoperating said non-numerical switch, a metering circuit, and means controlled by the reoperation of said switch for transmitting a number of metering impulses over said metering circuit.

13. In a measured service telephone system wherein a series of numerical automatic switches are controlled by a register sender to set up and complete a talking connection between a calling and a called line, a non-numerical hunting switch including a set of wipers and sets of bank contacts therefor, means responsive to a call on said calling line for operating said non-numerical hunting switch to connect said register sender to the first numerical automatic switch in said series by way of said set of wipers and said sets of bank contacts, means for disconnecting said non-numerical switch from said register sender and for restoring said set of wipers to normal position responsive to the selection of the called line, an additional wiper and bank of contacts therefor in said non-numerical hunting switch, means responsive to the called party answering for reoperating said non-numerical hunting switch, a metering circuit, and means controlled over said additional wiper and bank contacts by the reoperation of said switch for transmitting a number of metering impulses.

14. In a measured service telephone system wherein a series of automatic switches are operated to set up and complete a talking connection between a calling and a called line, a wiper on one of said automatic switches operated during the setting up of said connection to a position corresponding to the zone the called line is located in, an impluse sender associated with said one automatic switch, means for continuously operating said sender during the talking period of the established connection, a metering circuit, and means controlled by the operation of said sender for transmitting a predetermined number of metering impulses over said metering circuit dependent upon the position said wiper is operated to in setting up said connection.

CHARLES GILLINGS.
FRANCIS TATLOCK BELAS.