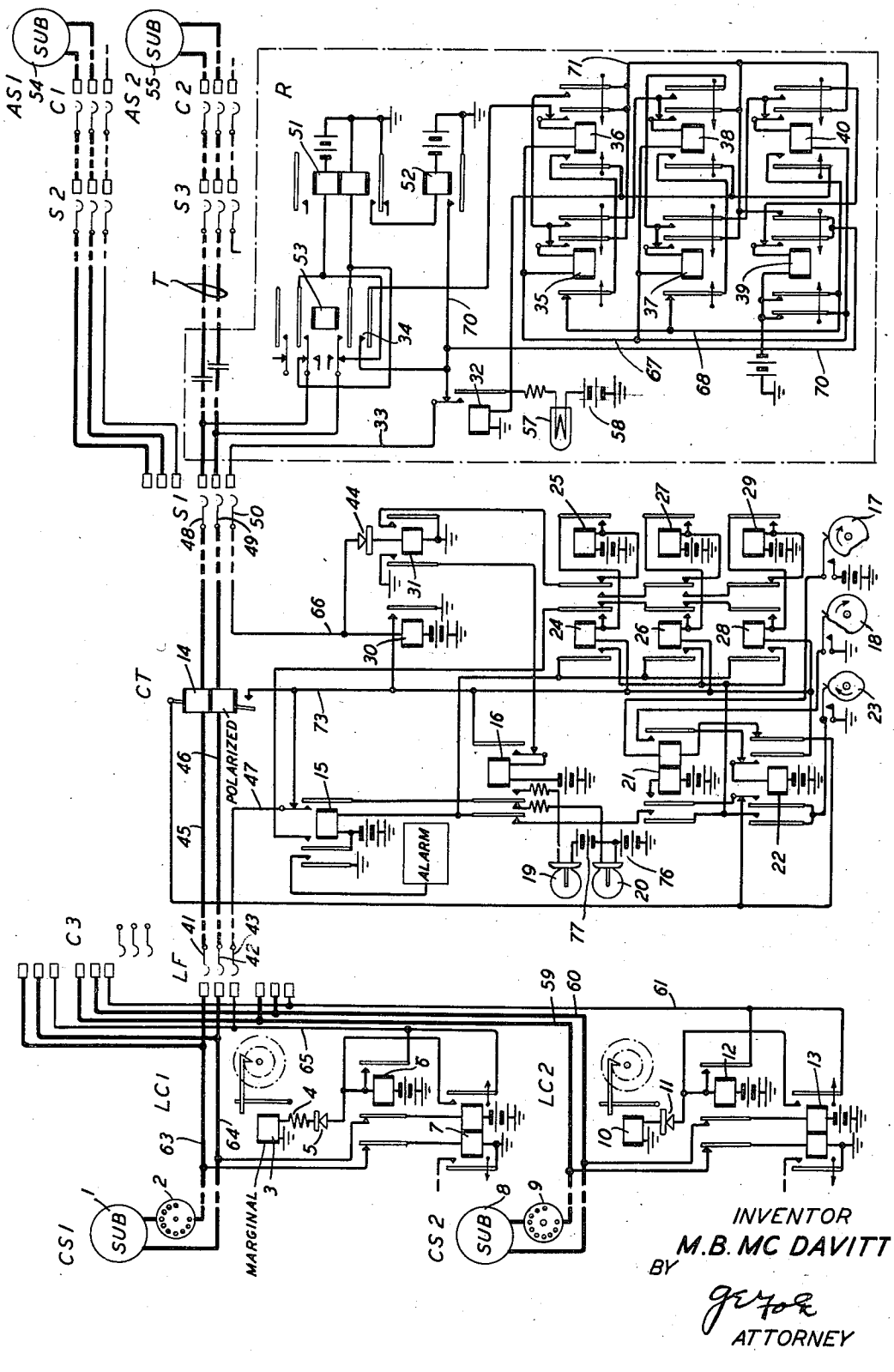
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates to telephone systems and more particularly to measured service telephone systems.

The object of the invention is to improve the control of service meters operating in accordance with the class of service to which a subscriber is entitled, and in accordance with the zone within which a called station is located.

It has been found desirable particularly in multi-office and suburban telephone systems to provide two or more classes of service. For instance, the subscribers' stations may be classified as residence stations and business stations, and the area may be divided into a first zone and a second zone. With such a classification, the residence rate subscribers will be given unlimited flat-rate service for calls to stations within the same zone as the calling station, and will be charged one meter operation for each call to stations in the other zone; the business rate subscribers will be charged one meter operation for each call to stations within the same zone as the calling station and will also be charged one meter operation for each call to the other zone. Were there four zones, the residence rate subscribers might be given unlimited flat-rate service within the same zone as the calling station, and be charged one, two or three meter operations for calls to stations in the other three zones; the business rate subscribers might be charged one meter operation for calls within the same zone as the calling station and one, two or three meter operations for calls to stations in the other three zones. These particular rate structures are merely illustrative of those which may obtain in telephone systems to which this invention is applicable.

According to this invention the subscribers' lines in one zone of a multi-zone telephone system are divided into two classes, an individual service meter is provided for each of these lines, and means are provided for causing the operation of the meters of lines of one class only on calls within the one zone and for causing the operation of the meters of both classes of lines on calls to lines in another zone.

One feature of the invention is the provision of two potential sources for operating the individual service meters of two classes of subscribers' lines, each of the meters of lines of one class being operatively responsive to its connection to one of said potential sources, and each of the meters of lines of the other class being operatively responsive to its connection to the other of said potential sources.

Another feature of the invention is the provision of two potential sources for operating the individual service meters of subscribers' lines of two classes, each of the meters of lines of one class being operatively responsive to its connection to one of said potential sources and each of the meters of lines of the other class being operatively responsive to its connection to either of said potential sources.

A further feature of the invention is the provision of resistances, one in series with each of the meters of the subscribers' lines of one class, whereby the meters of lines of said one class are rendered operatively responsive only to a certain minimum meter operating potential and the meters of the lines of the other class are operatively responsive to a substantially lower meter operating potential.

A further feature of the invention is the provision of one meter operating potential source for use on calls between lines in one zone and another meter operating potential source for use on calls from lines in the one zone to lines in another zone.

Another feature of the invention is the provision of one meter operating potential source for use on calls between lines in one zone and another meter operating potential source for use on calls between lines in said one zone and for use on calls from lines in said one zone to lines in another zone.

A further feature of the invention is a trunk circuit for controlling the operation of a calling subscriber's meter in accordance with the zone within which the called line is located with respect to the calling line, the outgoing sleeve conductor of the trunk being connected to the winding of a holding relay and also to the winding of a zone-signal receiving relay, in series with a unidirectional conductor, the unidirectional conductor being poled to prevent the operation of the zone relay in series with the holding relay. This arrangement enables the operation of the holding relay by the connection of ground potential to the sleeve conductor and the operation of the zone relay by the connection of booster-battery potential in place of the ground potential without causing the release of the holding relay.

A telephone system arranged in accordance with this invention is shown schematically in the drawing which forms a part of this specification. The invention is not, however, limited in its application to the particular system illustrated.

Referring to the drawing, CS1, CS2, AS1 and AS2 represent subscribers' stations in a multi-

office telephone system, LC1 and LC2 represent line apparatus individual to each of the stations CS1 and CS2, LF represents a line-finder switch, CT represents a charging trunk through which the line-finder LF is permanently connected to a first selector switch S1, S2 represents an intermediate selector switch, and C1 and C3 represent connector switches. All of the switches LF, S1, S2, C1 and C3 are in the same office. R represents an outgoing trunk repeater associated with the interoffice trunk T which is connected to an incoming selector S3 in another office. C2 represents a connector switch, the switches S3 and C2 being in the same or different offices.

The system represented in the drawing is divided into four zones. Stations CS1, CS2 and AS1 are in zone 1 and station AS2 is in zone 4. The zone in which stations CS1 and CS2 are located may consist of only the one office in which these stations are located or may consist of this office and adjacent offices. Station CS1 is a residence-rate station given flat-rate (non-metered) service within zone 1 and message-rate (metered) service beyond zone 1. Station CS2 is a business-rate station given message-rate (metered) service on all calls. The number of meter operations for calls originating at stations CS1 and CS2 are as follows:

Calls from station	To			
	Zone 1	Zone 2	Zone 3	Zone 4
CS1	0	1	2	3
CS2	1	1	2	3

It is, of course, apparent that this system might be considered to be a 3-zone system in which a residence-rate subscriber is given flat-rate service for calls within a portion of the zone within which it is located and metered service for all other calls and in which a business-rate subscriber in the same office is given metered service for all calls.

The subscribers' stations are all of the type usually employed in automatic telephone systems, stations CS1 and CS2 including the impulse dials 2 and 9 respectively for use in calling other stations. The line apparatus LC1, individual to station CS1, comprises the line relay 7, cut-off relay 6 and service meter 3. The line apparatus LC2, individual to station CS2, comprises the line relay 13, cut-off relay 12 and service meter 10. The winding of meter 3 of station CS1 is connected through a resistance 4 and unidirectional conductor 5 to the winding of cut-off relay 6; but the winding of meter 10 of station CS2 is connected directly through unidirectional conductor 11 to the winding of cut-off relay 12. The unidirectional conductors 5 and 11 are each poled to prevent current through the cut-off relay and associated meter in series so that each of these meters can be operated only by the connection of a booster-battery potential to the sleeve conductor 65 or 61. The resistance 4 makes necessary the connection of a higher positive potential to sleeve conductor 65 to operate meter 3 of residence-rate station CS1 than that which is sufficient to operate meter 10 of business-rate station CS2 when connected to the sleeve conductor 61. The line conductors 63, 64 and 65 of LC1 and the line conductors 59, 60 and 61 of LC2 connect to different sets of terminals in the bank of the line-finder switch LF and to different sets of terminals in the bank of the connector switch C3. The line apparatus for stations AS1 and AS2 is not shown.

The line-finder switch LF, first selector switch S1, intermediate selector switch S2, incoming selector switch S3 and connector switches C1, C2 and C3 are all of the well-known Strowger two-motion step-by-step type. For a complete description of the construction and operation of a Strowger type switch and its operation when used as a selector or connector, reference may be had to pages 53 to 65 inclusive, of the second edition of Automatic Telephony by Smith and Campbell published in 1921. For a description of the operation of a Strowger type switch when used as a line-finder reference may be had to Patent 1,799,654 granted to R. L. Stokely, April 7, 1931. Each of the line-finder, selector and connector switches is represented by a set of brushes and one or two sets of terminals. The broken lines leading to the brushes of each of these switches indicates, in each case, that the magnets and other associated apparatus have been omitted.

The charging trunk CT comprises the talking conductors 45 and 46, the incoming sleeve conductor 47, the outgoing sleeve conductor 66, a polarized supervisory relay 14, a holding relay 30, a sleeve control relay 15, sources of meter operating potential 76 and 77 and a controlling relay 16, a relay 31 for receiving zone indicating signals, zone register and metering control relays 24 to 29, inclusive, and the charge delay relays 21 and 22. The interrupters 17, 18 and 23 are used in controlling the operation of relays 15, 21 and 22. A complete description of the operation of the charging trunk CT will be included in the following description of the completion of calls originating at stations CS1 and CS2.

The outgoing repeater R is a modification of the impulse repeater shown in Fig. 67 and described on pages 70 to 72 of the second edition of Automatic Telephony by Smith and Campbell and is used to repeat dial impulses over the associated outgoing trunk T to control the operation of the incoming selector S3 and the succeeding switches used in completing a desired connection in well-known manner. The modification consists of the addition of contact 34 to the reversing relay 53, the addition of three pairs of zone relays 35 and 36, 37 and 38, and 39 and 40, and the addition of booster-battery 58 and zone signaling relay 32. The added apparatus is operative in response to the answer of the called subscriber on a call completed over trunk T, to close a zone signaling circuit three times in succession to indicate to the charging trunk, with which the repeater is connected, that the trunk T is one extending into zone 4. A repeater associated with an outgoing trunk extending into zone 3 is modified in like manner except that there are only two pairs of zone relays; a repeater associated with an outgoing trunk extending into zone 2 is modified in like manner except that there is only one pair of zone relays; and a repeater associated with an outgoing trunk extending to some other office in zone 1 has no added apparatus and is identical with that shown in Fig. 67 of the aforementioned second edition of Automatic Telephony. The operation of the added apparatus is described in detail in the following description of the completion of calls originating at stations CS1 and CS2.

Assume that the subscriber at station CS1 desires a connection with station AS2 which, as

hereinbefore stated is located in zone 4. Upon removing the receiver from the switch-hook, a circuit is closed from battery through the right-hand winding of relay 7, inner left-hand contacts of cut-off relay 6, over conductor 64, subscriber's set 1, dial 2, over conductor 63, outer left-hand contacts of relay 6, to ground through the left-hand winding of relay 7. Relay 7 operates and connects the winding of cut-off relay 6 over conductor 65 to mark the sleeve terminal of the calling line in the banks of the line-finder switches to which the line is connected. Relay 7 also closes with its left-hand contacts a circuit, not shown, that causes line-finder LF to hunt for, and establish connection through brushes 41, 42 and 43 with the terminals to which the conductors 63, 64 and 65 are connected. The line-finder LF connects ground, not shown, through brush 43 to conductor 65 thereby causing the operation of cut-off relay 6. Relay 6 locks through its right-hand contacts over conductor 65 and opens the circuit through the windings of relay 7. Relay 7 is made slow in releasing so that the locking circuit for relay 6 will be closed before its operating circuit is opened by the release of relay 7.

Upon extension of the calling line through the brushes of line-finder LF over conductors 45 and 46 of charging trunk CT to the first selector S1, holding ground potential is connected to sleeve conductor 66 and dial tone is transmitted to the calling station all in well-known manner. Although a circuit is normally closed from battery through the winding of relay 30, unidirectional conductor 44, and winding of relay 31 to ground, conductor 44 is so poled as to prevent the operation of either of these relays in this circuit. Upon the connection of holding ground potential to conductor 66, conductor 44 and the winding of relay 31 are short-circuited and relay 30 alone is operated. The operation of relay 30 connects ground through its front contact over conductor 73 and through the back contact of relay 15, to the incoming sleeve conductor 47 to hold the line-finder LF and the cut-off relay 6 in usual manner.

Upon hearing the dial tone, the calling subscriber dials the number of the called station AS2. The selector S1 is selectively operated in response to the impulses created by the dialing of the first digit to extend the connection from the calling line to an outgoing trunk repeater R associated with an interoffice trunk over which the desired connection may be completed. Upon extension of the calling line to the repeater R, the line relay 51 is operated, the operating circuit being traced from battery through the upper winding of relay 51, lower back contact of reversing relay 53, through brush 49 of selector S1, lower winding of supervisory relay 14 and conductor 46 of trunk CT, brush 42 of line-finder LF, line conductor 64, station CS1, line conductor 63, brush 41 of line-finder LF, conductor 45 and the upper winding of supervisory relay 14 of trunk CT, brush 48 of selector S1, inner upper back contact of relay 53 and through the lower winding of relay 51 to ground. The current in this circuit is not effective to operate the polarized supervisory relay 14 of charging trunk CT. In operating, relay 51 closes a circuit for operating relay 52 and relay 52 connects ground over conductor 70 and through the back contact of relay 32 to the sleeve conductor 33 to hold the first selector switch S1 in usual manner and to hold relay 30 operated.

The line relay 51 of repeater R responds to the impulses created by the dialing of the second and succeeding digits of the called number to repeat each train of impulses over trunk T, the first repeated train of impulses being effective to control the selective operation of the incoming selector switch S3 and the last two repeated trains of impulses being effective to control the selective operation of the connector switch C2 to establish connection with the line leading to the called station AS2. The called line is tested and if idle, ringing current is transmitted to operate the ringer at station AS2 all in well-known manner.

The removal of the receiver at station AS2 to answer the call causes the operation of the supervisory relay 53 of repeater R in usual manner thereby reversing the current through the windings of supervisory relay 14 of charging trunk CT to cause the operation of this polarized relay. The operation of relay 53 also closes a circuit from ground through the operated contact of relay 52, over conductor 70 through contacts 34 of relay 53, back contact and winding of relay 36, over conductor 67 and through the outer left-hand contacts of relay 39 to battery. Relay 36 is operated and it locks over conductor 71, through the outer right-hand contacts of relay 39 to ground over conductor 70. Relay 36, in operating, closes a circuit, for operating relay 32, from battery through the inner left-hand contacts of relay 39, over conductor 68, through the left-hand contacts of relay 35, left-hand contacts of relay 36, and through the winding of relay 32 to ground. Relay 32, in operating, closes a circuit from the positive pole of grounded booster-battery 58, through resistance lamp 57, right-hand operated contacts of relay 32, conductor 33, brush 50 of selector switch S1, to conductor 66 of trunk CT, thence through the winding of relay 30 to battery and from conductor 66 through unidirectional conductor 44 and the winding of relay 31 to ground. The current through the winding of relay 30 is thereby increased to hold this relay operated. Conductor 44 is so poled that there is also a current through the winding of relay 31 to cause the operation of this relay. When relay 36 operated, it also closed a circuit, for operating relay 35, from ground over conductor 70, through the outer right-hand contacts of relay 39, over conductor 71, through the outer right-hand contacts of relay 36, right-hand back contact and winding of relay 35, over conductor 67, and through the left-hand outer contacts of relay 39 to battery. Relay 35, in operating, opens at its left-hand contacts the operating circuit for relay 32. Relay 32 accordingly releases, disconnecting booster-battery 58 from conductor 33 to cause the release of relay 31 and reconnecting ground to this conductor to hold relay 30. Relay 35 also locks, through its inner right-hand contacts, over conductor 71 and through the outer right-hand back contact of relay 39 to ground over conductor 70. Relay 35, in operating, also closes a circuit, for operating relay 38, from battery through the outer left-hand contacts of relay 39, over conductor 67, through the winding and back contact of relay 38, through the outer right-hand contacts of relays 35 and 36, over conductor 71, through the outer right-hand back contact of relay 39, and over conductor 70 to ground. Relay 38, in operating, locks through its inner right-hand front contact and closes a circuit for again operating relay 32; this circuit includes the inner left-hand

contacts of relay 39, conductor 68, the left-hand contacts of relay 37, and the left-hand contacts of relay 38. Relay 32, in operating, reconnects booster-battery 58 to sleeve conductor 33 to cause the reoperation of relay 31 of trunk CT. Relay 33, in operating, also closes a circuit for operating relay 37; this circuit includes the outer left-hand contacts of relay 39, conductor 67, the winding and right-hand back contact of relay 37, the outer right-hand contacts of relays 38, 35 and 36, conductor 71, and the outer right-hand contacts of relay 39. Relay 37, in operating, locks through its inner right-hand front contact and opens at its left-hand contacts the operating circuit for relay 32. The release of relay 32 causes the release of relay 31. Relay 37 in operating, also closes a circuit for operating relay 40; this circuit includes conductor 67, the winding and back contact of relay 40, outer right-hand contacts of relays 37, 33, 35 and 36, conductor 71, outer right-hand contacts of relay 39 and conductor 70. Relay 40, in operating, locks through its inner right-hand contacts over conductors 71 and 70 and closes a circuit for again operating relay 32; this circuit includes conductor 68 and the left-hand contacts of relay 40. Relay 32, in operating, reconnects booster-battery 58 to sleeve conductor 33 to cause the reoperation of relay 31. Relay 40 also closes a circuit for operating relay 39; this circuit is traced from battery through the winding and inner right-hand back contact of relay 39, outer right-hand contacts of relays 40, 37, 38, 35 and 36, over conductor 71, and through the outer right-hand contacts of relay 39 to ground over conductor 70. Relay 39 operates and locks through its front contact to ground over conductor 70. The locking contacts of relay 39 close before the operating circuit is opened. The operation of relay 39 causes the release of relays 32, 35, 36, 37, 38 and 40. The release of relay 32 disconnects the booster-battery from conductor 33 to cause the release of relay 31 and reconnects ground potential to this conductor to hold relay 30. Each of relays 35 to 40, inclusive, is slow in operating to insure that each operation and release of relay 32 will effect a corresponding operation and release of relay 31 of trunk CT.

The aforementioned three successive operations of relay 31 of charging trunk CT, effected under the control of the zone relays of repeater R, indicates to trunk CT that the called subscriber's station is located in zone 4. The first of these three operations of relay 31 closes circuits for operating relays 16 and 25. Relay 16 locks through its right-hand front contact to ground through the contacts of relay 30. When relay 31 releases after its first operation, relay 25 is held operated and relay 24 is operated by the current in a circuit from battery through the winding and contacts of relay 25, winding of relay 24, and through the contacts of relay 30 to ground. The second operation of relay 31 closes a circuit for operating relay 27; this circuit may be traced from battery through the winding of relay 27, outer right-hand back contact of relay 26, outer right-hand front contact of relay 24 and right-hand front contact of relay 31 to ground. When relay 31 releases a second time, relay 27 is held operated and relay 26 is operated by the current in a circuit traced from battery through the winding and contacts of relay 27, and through the winding of relay 26 to ground at relay 30. When relay 31 operates for the third time, relay 29 is operated by the current in a circuit traced from battery through the winding of relay 29, right-hand back contact of relay 28, outer right-hand front contacts of relays 26 and 24 to ground at relay 31. When relay 31 releases a third time, relay 29 is held operated and relay 28 is operated by the current in a circuit traced from battery through the winding and contacts of relay 29 and through the winding of relay 28 to ground at relay 30.

The aforementioned operation of the polarized supervisory relay 14, resulting from the answer of the called subscriber, is effective to initiate the operation of the charge-delay relays 21 and 22 under the control of interrupters 17 and 18 and the operation of relay 15 under the control of interrupter 23. The contacts of interrupter 23 are closed once every second for .5 second, and the contacts of interrupters 17 and 18 are each closed for .25 second once every two seconds. Each closure of the contacts of interrupter 18 begins at the same time as every second closure of the contacts of interrupter 23; and each closure of the contacts of interrupter 17 begins at the end of each closure through the contacts of interrupter 18. As soon after the operation of relay 14 as the contacts of interrupter 17 are closed, the pick-up relay 21 is operated by current in a circuit from battery through the contacts of pick-up interrupter 17, right-hand winding of relay 21, outer right-hand back contact of relay 22, contacts of relay 14, to ground at relay 30. Relay 21 locks under control of relay 14, the locking circuit being traced from battery through the left winding and inner left front contact of relay 21, left back contact of relay 22 and through the contacts of relay 14 to ground at relay 30. If relays 14 and 21 remain operated until the contacts of interrupter 18 are next closed (an interval of from 1.5 to 2 seconds) relay 22 is operated by the current in a circuit from battery through its winding and inner right back contact, right front contact of relay 21 and through the contacts of interrupter 18 to ground. Relay 22 locks through its right front contact under the sole control of relay 30. It is apparent, therefore, that a temporary operation of relay 14, such as might occur due to a busy signal, is ineffective to cause the operation of relay 22. In operating, relay 22 opens the aforementioned circuit for holding relay 21 and closes another circuit for holding relay 21 another .5 second, that is, until the contacts of interrupter 23 are opened; this circuit is traced from battery, through the winding and inner left front contact of relay 21, inner left front contact of relay 22, and through the contacts of interrupter 23. Relay 22 also disconnects the right winding of relay 21 from the pick-up interrupter 17 to prevent the reoperation of relay 21 after it releases. Relay 22 also closes a circuit from ground through the contacts of interrupter 23, outer left front contact of relay 22, left front contacts of relays 24, 26 and 28 in parallel, and through the winding of relay 15 to battery. In operating, relay 15 disconnects the incoming sleeve conductor 47 from ground potential at relay 30 and connects this conductor through the left front contact of relay 16 and resistance lamp 19 to the positive pole of a booster battery comprising the batteries 77 and 76 in series. The connection of this positive potential over conductor 47 through brush 43 of line-finder LF to conductor 65 is effective to hold the cut-off relay 6 operated and to cause the operation of the meter 3, the unidirectional conductor 5 being poled so that there is a current through the winding of meter 3 when a pos-

itive potential is connected to conductor 65. In operating, relay 15 also connects battery through its inner left front contact and the inner right front contact of relay 24 to the windings of relays 24 and 25 so as to short-circuit the winding and thereby cause the release of relay 25. As soon thereafter as the contacts of interrupter 23 are opened, relays 21 and 15 release. The release of relay 15 causes the release of relay 24 and the release of meter 3, the sleeve conductor 47 being again connected to ground potential in place of booster battery potential.

The next succeeding closure and opening of the contacts of interrupter 23 cause a second operation and release of relay 15, the operating circuit including the left front contacts of relays 26 and 28 in parallel. The second operation and release of relay 15 cause a second operation and release of meter 3. The second operation of relay 15 also connects battery through the inner left front contact of relay 15, the inner right back contact of relay 24 and the inner right front contact of relay 26 to the windings of relays 26 and 27 so as to short-circuit the winding and cause the release of relay 27. When relay 15 releases, relay 26 is also released. The next succeeding closure and opening of the contacts of interrupter 23 cause a third operation and release of relay 15, the operating circuit including the left front contact of relay 28. The third operation and release of relay 15 cause a third operation and release of meter 3. The third operation of relay 15 also connects battery through the inner left front contact of relay 15, the inner right back contacts of relays 24 and 26 and the inner right front contact of relay 28 to the windings of relays 28 and 29 so as to short-circuit the winding and cause the release of relay 29. When relay 15 releases, relay 28 is also released and relay 15 cannot thereafter be reoperated, all of relays 24, 26 and 28 having been released.

The meter 3 of station CS1 in zone 1, having been operated three times for the completed call to station AS2 in zone 4, no further action occurs until the connection is released. The opening of the line circuit by placing the receiver on the receiver hook at station AS1 causes the release of line relay 51 of repeater R and the release of relay 14 of trunk CT. The release of relay 51 causes the release of relay 52; and the release of relay 52 disconnects ground potential from sleeve conductor 33, thereby causing the release of the holding relay (not shown) of selector S1 and the release of relay 30 of trunk CT. The selectors S1 and S3 and connector C2 are returned to normal in usual manner. The release of relay 30 disconnects ground potential from conductors 73 and 47, thereby releasing the cut-off relay 6 and holding relay (not shown) of line-finder LF, the line-finder switch being thereupon restored to normal in usual manner. The release of relay 30 also causes the release of relays 16 and 22. All of the apparatus involved in the described connection is ready for use in another connection.

On a call from station CS1 to a station in zone 3, the repeater involved in the connection has only two sets of zone relays and only two operations of relay 31 of charging trunk CT results from the operation of the reversing relay in response to the answer of the called subscriber. In this case, relays 24 and 25 and relays 26 and 27 of trunk CT are operated but relays 28 and 29 are not operated. With only two sets of the metering control relays of trunk CT operated, relay 15 is operated twice only and the meter 3 is, therefore, only operated two times as a charge for the call.

On a call from station CS1 to a station in zone 2, the repeater involved in the connection has only one set of zone relays and only one operation of relay 31 of charging trunk CT results from the operation of the reversing relay in response to the answer of the called subscriber. In this case relays 24 and 25 of trunk CT are operated but relays 26 and 27 and relays 28 and 29 are not operated. With only one set of the metering control relays of trunk CT operated, relay 15 is operated once only and the meter 3 is, therefore only operated once as a charge for the call.

On a call from station CS1 to another station in zone 1, no repeater is included in the connection if the called station is in the same office but a repeater may be included if the called station is in another office. In the latter case, the repeater involved in the connection is identical with that shown in the aforementioned Fig. 67 of the second edition of Automatic Telephony. In either case the relay 31 of trunk CT is not operated, none of the metering control relays 24 and 25, 26 and 27 and 28 and 29 are operated, and relay 16 is not operated. The operation of the polarized supervisory relay 14 in response to the answer of the called station causes the operation of relays 21 and 22 as hereinbefore described. When relay 22 operates and relay 21 is held operated by current through its left-hand winding for .5 second until the contacts of interrupter 23 are opened, a circuit is closed from ground through these interrupter contacts, outer left front contacts of relays 22 and 21, the outer left back contact of relay 16, and the winding of relay 15 thereby causing one operation of relay 15. Relay 15, in this case, connects sleeve conductor 47 through the right front contact of relay 15, inner left back contact of relay 16, and through resistance lamp 20 to the positive pole of booster-battery 76. The positive potential thus impressed over conductor 47 through brush 43 onto conductor 65 is insufficient to cause the operation of the marginal meter 3, the current through the winding of meter 3 being limited not only by the impressed potential but also by the resistance 4.

Consider now a call from the business-rate station CS2, completed through line-finder LF and charging trunk CT. If the called station is in one of zones 2, 3 and 4, a repeater similar to the repeater R is used in each case in completing the connection, and the answer of the called subscriber results in three operations of meter 10 in the same manner that the similar above-described call from station CS1 resulted in three operations of meter 3. If the called station is in zone 3, only two sets of the metering control relays of charging trunk CT are operated and two operations of meter 10 result from the answer of the called subscriber. If the called station is in zone 2, only one set of the metering control relays of charging trunk CT are operated and one operation of meter 10 results from the answer of the called subscriber. If the called station is in zone 1, either in the same or a different office from that of the calling station, none of the metering control relays of trunk CT are operated; but the connection of the positive pole of booster-battery 76 to conductor 47 as hereinbefore described and thence through brush 43 of line-finder LF to conductor 61 is effective to

cause the operation of meter 10 since the winding of meter 10 is connected directly to the unidirectional conductor 11, there being no resistance in series with the winding of meter 10 similar to resistance 4 which is in series with the winding of meter 3. Thus the business-rate station CS2 is charged one meter operation for a call to another station in zone 1 while the meter 3 of residence-rate station CS1 is not operated for such a call.

What is claimed is:

1. In a telephone system, subscribers' lines of one class, subscribers' lines of a different class, service meters one for each of said lines, a source of potential for use in operating the meters of the lines of one class, and another source of potential for use in operating the meters of the lines of the other class.

2. In a telephone system, one subscriber's line, another subscriber's line, service meters one for each of said lines, two different potential sources for use in operating the service meter of a calling line, and means for rendering the meter of one of said lines operatively responsive to its connection to only one of said potential sources.

3. In a telephone system, subscribers' lines of one class, subscribers' lines of a different class, service meters one for each of said lines, a source of potential for use in operating the meters of lines of one class, another source of potential for use in operating the meters of lines of both classes, and automatic means for selectively connecting the meter of a calling line to either of said sources of potential.

4. In a telephone system, a first subscriber's station and a second subscriber's station, said first subscriber being entitled to one class of service and said second subscriber being entitled to another class of service, a service meter for said first station, a like service meter for said second station, a resistance connected in series with the winding of one of said meters to necessitate the connection of a substantially higher potential to cause the operation of said one meter than is sufficient to cause the operation of the other meter, and means for operating either one of said meters.

5. In a telephone system, a first subscriber's station and a second subscriber's station, said first subscriber being entitled to one class of service and said second subscriber to another class of service, a service meter for said first station, a service meter for said second station, other subscribers' stations, means for establishing a talking connection between either one of said first and second stations and a called station, a source of potential of such a character as to be effective to cause the operation of the first of said meters and ineffective to cause the operation of the other of said meters, a second source of potential of such a character as to be effective to cause the operation of either of said meters, and means for connecting either one of said sources of potential in series with the winding of the meter of the calling station.

6. In a telephone system, a first subscriber's station, and a second subscriber's station, said first subscriber being entitled to one class of service and said second subscriber being entitled to another class of service, a service meter for said first station, a like service meter for said second station, a resistance connected in series with the winding of one of said meters to necessitate the connection of a substantially higher potential to cause the operation of said one meter than is sufficient to cause the operation of the other meter, other subscribers' stations, means for establishing a talking connection between either one of said first and second stations and a called station, and means operatively responsive to the answer of the called subscriber for causing the operation of the meter of the calling station.

7. In a telephone system, a first subscriber's station and a second subscriber's station, said first subscriber being entitled to one class of service and said second subscriber to another class of service, a service meter for said first station, a service meter for said second station, other subscribers' stations, means for establishing a talking connection between either one of said first and second stations and a called station, a source of potential of such a character as to be effective to cause the operation of the first of said meters and ineffective to cause the operation of the other of said meters, a second source of potential of such a character as to be effective to cause the operation of either of said meters, and means responsive to the answer of the called subscriber for connecting either one of said sources of potential in series with the winding of the meter of the calling station.

8. In a multi-zone telephone system, subscribers' lines in one zone, service meters one for each of said lines, subscribers' lines in another zone, meter operating means comprising a source of potential of one character for use on calls from a line in said one zone to a line in the same zone, and meter operating means comprising a source of potential of a different character for use on calls from a line in said one zone to a line in said other zone.

9. In a multi-zone telephone system, subscribers' lines in one zone, service meters one for each of said lines, subscribers' lines in another zone, meter operating means comprising a source of potential of one character for use on calls from a line in the one zone to a line in said other zone, and meter operating means comprising a source of potential of a different character for use on calls from a line in the one zone to a line in the other zone and on calls from a line in the one zone to another line in the same zone.

10. In a telephone system, subscribers' stations in each of a plurality of zones, means for establishing a connection between a calling station and a called station, a service meter for said calling station, a source of potential of one character, a source of potential of a different character, and means operatively responsive to the answer of the called subscriber and dependent upon the zone within which the called station is located with respect to the calling station for temporarily connecting the one or the other of said sources of potential in series with the meter of the calling station a single time or successively connecting one of said sources of potential in series with the meter of the calling station a plurality of times.

11. In a telephone system, subscribers' stations in each of a plurality of zones, means for establishing a connection between a calling station and a called station, a service meter for said calling station, a source of potential of one character, a source of potential of a different character, means for connecting one of said sources of potential in series with the meter of the calling station if the called station is in the same zone as the calling station, and means for connecting the other of said sources of potential in series with the meter of the calling station if the called station is in a

different zone from that in which the calling station is located.

12. In a telephone system, subscribers' stations in each of a plurality of zones, means for establishing a connection between a calling station and a called station, a service meter for said calling station, a first source of potential, a second source of potential substantially higher than the first, and means operatively responsive to the answer of the called subscriber and dependent upon the zone within which the called station is located with respect to the calling station for temporarily connecting the first of said sources of potential in series with the meter of the calling station a single time or temporarily connecting the second of said sources of potential in series with the meter of the calling station one or more times in succession.

13. In a telephone system, subscribers' stations in each of a plurality of zones, means for establishing a connection between a calling station and a called station, a service meter for said calling station, a source of potential of one character, a source of potential of a different character, and means operatively responsive to the answer of the called subscriber for temporarily connecting one of said sources of potential in series with the meter of the calling station if the called station is in a certain one of said zones and for temporarily connecting the other of said sources of potential in series with the meter of the calling station if the called station is in a zone other than said certain zone.

14. In a telephone system, subscribers' stations in each of a plurality of zones, means for establishing a connection between a calling station and a called station, a service meter for said calling station, a source of potential of one character, a source of potential of a different character, and means operatively responsive to the answer of the called subscriber for temporarily connecting one of said sources of potential in series with the meter of the calling station if the called station is in a certain one of said zones and for temporarily connecting the other of said sources of potential in series with the meter of the calling station one or more times if the called station is in a zone other than said certain zone, the number of times said other source of potential is connected in series with the meter of the calling station being dependent upon the particular one of said other zones in which the called station is located.

15. In a telephone system, subscribers' lines in each of a plurality of zones, means including a first trunk for establishing a connection between a calling and a called line, a second trunk included in said connection if the calling and called lines are in different zones, a first relay, the winding of said first relay being connected to the outgoing sleeve conductor of said first trunk, means for connecting a ground potential to the outgoing sleeve conductor of said first trunk to operate said first relay, a second relay, a unidirectional conductor, ground potential being connected through the winding of said second relay in series with said unidirectional conductor to a point in the connection between the winding of said first relay and said sleeve conductor, said unidirectional conductor being poled to prevent current through the windings of said relays in series, and means associated with said second trunk for connecting a booster-battery potential to said sleeve conductor in place of said ground potential.

16. In a telephone system, subscribers' lines in each of a plurality of zones, means including a first trunk for establishing a connection between a calling line and a called line, a second trunk included in said connection if the calling and called lines are not in the same zone, a first relay, the operation of said first relay being effective to connect a holding potential to the sleeve conductor of the calling line, the winding of said first relay being connected to the outgoing sleeve conductor of said first trunk, means controlled by the calling subscriber for connecting a ground potential to the outgoing sleeve conductor of said first trunk to operate said first relay, a second relay, a unidirectional conductor, ground potential being connected through the winding of said second relay in series with said unidirectional conductor to the junction point between the winding of said first relay and the outgoing sleeve conductor of said first trunk, said unidirectional conductor being poled to prevent the operation of said second relay due to its connection in series with the winding of said first relay, and means associated with said second trunk for connecting a booster-battery potential in place of ground potential to the outgoing sleeve conductor of said trunk whereby said second relay is operated without releasing said first relay.

17. In a telephone system, subscribers' lines in each of a plurality of zones, a local trunk, means responsive to a call being originated over one of said lines for extending said line to said trunk, a service meter for said calling line, meter operating means associated with said trunk, switching means for completing the call if the called line is in the same zone as the calling line, means including an outgoing trunk for completing the call if the called line is in a different zone from that in which the calling line is located, means associated with said switching means for connecting a holding ground to the sleeve conductor of said local trunk, means associated with said outgoing trunk for connecting a holding ground to the sleeve conductor of said local trunk, means associated with said outgoing trunk for temporarily connecting a booster-battery potential in place of the holding ground potential to the outgoing sleeve conductor of said local trunk, a relay associated with said local trunk and operated by the connection of holding ground potential to the sleeve conductor of said trunk, a second relay associated with said local trunk, a winding of said second relay being connected in series with a unidirectional conductor to the outgoing sleeve conductor of said local trunk, said unidirectional conductor being effective to permit the operation of said second relay only when said booster-battery potential is temporarily connected to said outgoing sleeve conductor, and means dependent upon said second relay for controlling said meter operating means in accordance with the zone in which the called line is located.

18. In a telephone system, subscribers' lines in each of a plurality of zones, means including a first trunk for establishing a connection between a calling and a called line, a second trunk included in said connection if the calling and called lines are in different zones, a first relay, the winding of said first relay being connected to the outgoing sleeve conductor of said first trunk, means for connecting a ground potential to the outgoing sleeve conductor of said first trunk to operate said first relay, a second relay, a unidirectional conductor, ground potential being connected through the winding of said second relay in series

with said unidirectional conductor to a point in the connection between the winding of said first relay and said sleeve conductor, said unidirectional conductor being poled to prevent the flow of current through the windings of said relays in series, and means associated with said second trunk for temporarily connecting a booster-battery potential in place of said ground potential to said sleeve conductor one or more times in succession to cause the operation and release of said second relay, the number of times said booster-battery is connected to said sleeve conductor being dependent upon the zone within which the called line is located.

19. In a telephone system, subscribers' lines in each of a plurality of zones, means including a first trunk for establishing a connection between a calling and a called line, a second trunk included in said connection if the calling and called lines are in different zones, a first relay, the winding of said first relay being connected to the outgoing sleeve conductor of said first trunk, means for connecting a ground potential to the outgoing sleeve conductor of said first trunk to operate said first relay, a second relay, a unidirectional conductor, ground potential being connected through the winding of said second relay in series with said unidirectional conductor to a point in the connection between the winding of said first relay and said sleeve conductor, said unidirectional conductor being poled to prevent the flow of current through the windings of said relays in series, and means associated with said second trunk for temporarily connecting a booster-battery potential in place of said ground potential to said sleeve conductor one or more times in succession to cause the operation and release of said second relay, the number of times said booster-battery is connected to said sleeve conductor being dependent upon the zone within which the called line is located, and zone register means controlled by said second relay.

20. In a telephone system, subscribers' lines in each of a plurality of zones, a local trunk for use in completing a connection between a calling and a called line, an outgoing trunk included in said connection if said calling and called lines are in different zones, a zone register associated with said local trunk, impulse receiving means associated with said local trunk for setting said zone register, and means associated with said outgoing trunk for transmitting signal impulses for operating said impulse receiving means, the number of said impulses transmitted being dependent upon the zone within which the called line is located.

21. In a telephone system, subscribers' lines in each of a plurality of zones, a first trunk for use in completing a connection between a calling and a called line, a second trunk included in said connection if said calling and called lines are in different zones, means associated with said second trunk for temporarily connecting a booster-battery potential to the sleeve conductor of said first trunk one or more times in succession, the number of times said booster-battery is connected to the said sleeve conductor being dependent upon the zone within which the called line is located with respect to the calling line, a relay associated with said first trunk and operatively responsive to each temporary connection of booster-battery to said sleeve conductor, and zone registering means controlled by said relay.

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