

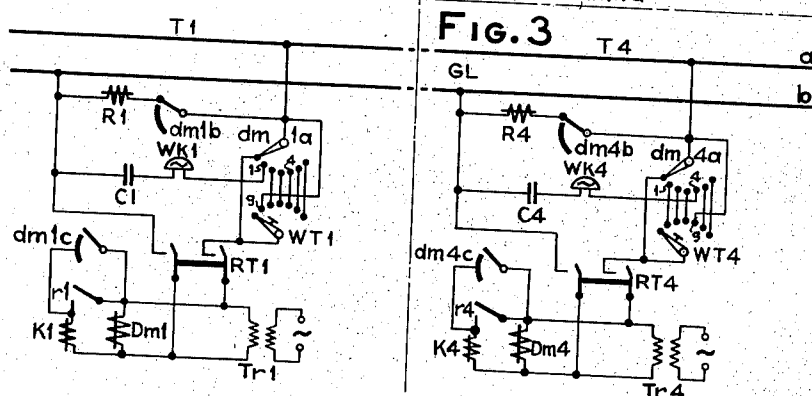
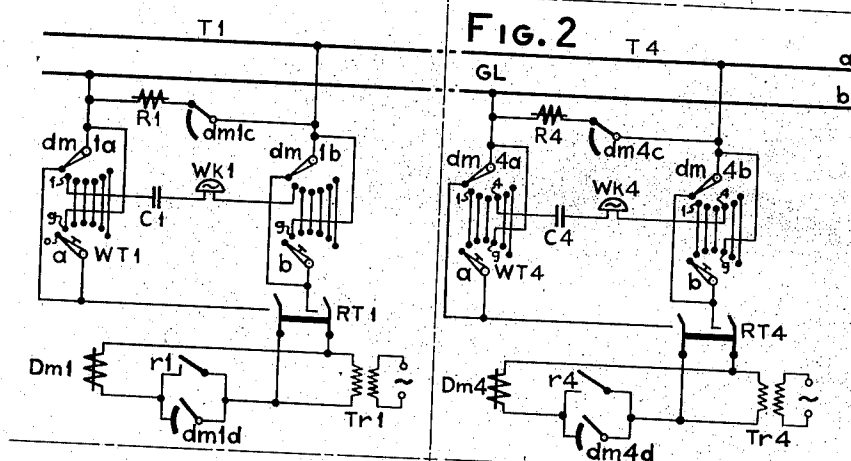
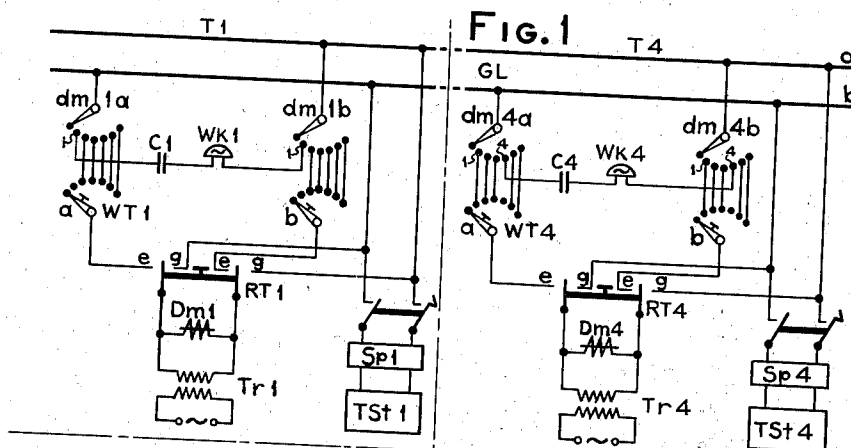
June 11, 1940.

R. URBAN

2,203,756

TELEPHONE SYSTEM

Filed Feb. 24, 1938



INVENTOR.
RICHARD URBAN

BY

Chas. W. Candy
ATTORNEY.

UNITED STATES PATENT OFFICE

2,203,756

TELEPHONE SYSTEM

Richard Urban, Berlin-Siemensstadt, Germany,
assignor to Siemens & Halske Aktiengesell-
schaft, Wernerwerk, Siemensstadt, near Berlin,
Germany

Application February 24, 1938, Serial No. 192,213
In Germany March 8, 1937

19 Claims. (Cl. 179—28)

The invention relates to a circuit arrangement for telephone systems with party lines. In order to be able to call a wanted branch station selectively in such systems it is known to use switches at the branch stations which are set synchronously at all the stations when a selecting operation is made. This synchronous setting of the switches can be brought about either by common step-by-step control from the sending station or it can be produced by stepping devices individual to the various stations which are merely set in operation together from the sending station.

In systems employing common step by step control of all the switches from the sending station difficulties are encountered if, when there are a large number of subscribers, the many parallel switches are to be set with certainty. Thus either large sources of sending current are necessary (a question of economy) or very sensitive receiving devices must be provided which are, however, also very prone to faults (a question of efficiency). On the other hand in systems where the switches are only started up in common and are then set synchronously by stepping devices individual to the branch stations, the means for ensuring the synchronous setting plays an important part. Thus it is difficult for example in systems in which the switches after having been started at each branch station operate under self-interrupter action, in the first place to start up the automatic interrupter circuits at all the branch stations together and then to maintain synchronism between them in all conditions of working (variation of battery potential or the like). Similarly in systems in which pendulums are used which are released on the commencement of selection and then oscillate freely, difficulties arise in respect of the equality in length of the various pendulums. In addition in these systems there also have to be provided the special devices for the satisfactory restoration of the pendulums to the rest position. In systems in which the switches are driven under spring action the time of operation is dependent upon the actual tension in the spring as is known in all such arrangements. A further important disadvantage resides in that the drive can only be effective when the springs at all the branch stations are fully wound.

The invention aims at securing an efficient synchronous operation of the switches at the branch stations of party lines, while using simple devices at the sending and receiving stations and this is achieved while avoiding the disad-

vantages of the previous solutions in that synchronous motors are provided as the selecting devices at the branch stations and are fed directly at the branch stations from an alternating current supply which is independent of the party line and is common to all the branch stations.

The arrangement according to the invention is particularly applicable where there is a common supply of alternating current accessible to all the branch stations so that the synchronous motors can be connected to this common supply in a similar manner to synchronous clocks. On account of the direct feeding from the alternating current supply, the considerable potential losses otherwise occurring when feeding over the party line are avoided. Since the consumption of small synchronous motors is very small, it is economically practical to have the synchronous motors permanently connected and to allow them to operate continually. Moreover, it is possible to provide special devices as for synchronous clocks which set the motors out of operation in the event of faults in the alternating current supply and also to indicate these faults to the subscriber and to bring the switches to rest in a pre-arranged position.

In systems in which the common supply is liable to be frequently out of order it is more advantageous not to allow the synchronous motors to run continuously but to connect them up only on the commencement of a selecting operation. The synchronous operation of these motors is then secured in a special manner.

The call sending and call receiving devices are particularly simple if the synchronous motors are equipped with rotary wipers which connect the ringing current which is connected in preparation to the calling station to the common line when the contact characterizing a wanted station is reached and brings about the operation of the calling devices at the wanted station.

If it is desired to avoid the contacts of the contact banks being subjected to too much wear by the permanently rotating synchronous motors and their associated wipers, it is preferable to couple the wipers with the permanently rotating synchronous motors only on the commencement of the selection.

With party lines it is frequently desired, not only to call individual subscribers of the line, but in special cases to call a number or all of the subscribers together (collective call). For this purpose the devices can be so arranged that on a collective call, bells are operated simultaneously

at all the branch stations. Since with this arrangement, however, the distribution of current over the line is unfavorable, it is preferable to ring the subscribers in succession over the individual calling positions as the rotary wipers rotate. For the purpose of characterizing a collective call the ringing key which otherwise serves for connecting up ringing current at the sending station can be used by bringing it into a special switching operation. A more satisfactory solution is obtained by using the switching position characterizing the calling station at the selecting switch as a collective call contact, since this contact at the calling station is free as an individual calling contact.

In order to prevent the speaking device being influenced in any way by the selecting current passing over the line, filter circuits can be arranged in front of the speaking devices to block the passage of the selecting current (having the usual mains frequency of 50) to the speaking devices without thereby prejudicing conversation.

Furthermore, blocking means can be provided at the branch stations which, during a selective operation for example in dependence upon selecting current transmitted over the line, prevent the transmission of further calls on the part of other stations. While a call is in progress no blocking means are necessary since secrecy is not provided and the subscribers determine whether the line is free or not by taking up their receivers and listening.

In the attached drawings, embodiments of the invention are shown to which the invention is not limited, in which

Fig. 1 shows a party line to which a plurality of branch stations can be connected.

Figs. 2 and 3 show modifications thereof.

In Fig. 1 there is shown a party line GL to which any number of branch stations can be connected. Each of these stations is provided with a synchronous motor *Dm* which is supplied over the transformer *Tr* from the alternating current network common to all the stations. When these synchronous motors have once been set in synchronism they operate continuously in synchronism provided that they are fed from the same network and no faults due to line breakages or the like occur. The synchronous motors are each provided with two wipers *dm* which pass over contacts, of which one is provided as a calling contact and enables a calling circuit to be closed, for example, over a bell *Wk*, this calling contact being arranged in a different position at each station in the known way. The other contacts traversed by the wiper are connected to corresponding contacts of a second contact bank which are connected by the wiper of a dial switch (WT) which is set by hand. In place of this dial switch other selecting devices can be used, for example key sets in which each key is connected to one of the contacts. At each station a ringing key (RT) is provided which according to its position (to the left or to the right) determines the type of call (individual call or collective call). The speaking devices (Tst) are connected to the common line over contacts controlled by the switchhook or the like. In order to avoid disturbing the speaking devices by the selecting current transmitted over the line, a blocking device *Sp* is provided before the speaking devices at each station and if for example low frequency alternating current is used for selecting, only passes high frequency (voice frequency) alternating current.

The mode of operation of the arrangement shown in Fig. 1 in which the branch stations T1 and T4 are shown is as follows:

In the rest condition of the system the synchronous motors *Dm* are connected to the common network over the transformers *Tr* at all the branch stations. They operate continuously under the influence of the alternating current. If now, for example, subscriber T1 wishes to call subscriber T4, he tests by way of his telephone to see whether the line is already engaged. If the line is free he sets his dial switch WT1 with its two wipers *a* and *b* on contact 4 of the wanted subscriber. The wipers *dm1a* and *dm1b* which are rotating at this time remain ineffective until the ringing key RT at the calling station is thrown to the left so that the following circuit is set up: transformer *Tr1*, ringing key RT1 in position *e*, wiper *a* of the dial switch WT1 on contact 4, wiper *dm1a* on contact 4 and *b* lead of the common line GL, wiper *dm4a* at the station T4 on contact 4, condenser C4, bell *Wk4*, wiper *dm4b* on contact 4, *a* lead of the common line GL, wiper *dm1b* on contact 4, wiper *b* of the dial switch WT1 on contact 4, ringing key RT1 in position *e*, transformer *Tr1*. The selecting current flowing in this circuit operates the bell *Wk4* at the wanted station on every rotation of the wipers (*dm*) during the time in which the wipers *dm1* and *dm4* are on the contact 4 which is constructed as a segment. The ringing is thus repeated as long as the ringing key RT1 remains depressed. When the wanted subscriber replies conversation can take place. During this time also the wipers of the synchronous motors are rotating.

It is also possible in one revolution of the wipers of the synchronous motors to call not only one subscriber but any desired number of subscribers. For this, it is necessary to use key sets or the like as selecting switches which enable a plurality of keys to be operated in one selective operation.

In order to prevent during the calling of one branch station further calls proceeding between other stations, busy signals and blocking devices can be arranged and be fed, for example, by the alternating current transmitted over the common line during calling.

At the end of the call the subscribers hang up their receivers. The system can be so arranged that the selecting switch WT is restored to normal again through the replacement of the receiver; the selecting switch can alternatively remain in its operated position independently of the replacement of the receiver until the next call is initiated.

If a collective call (conference call) to all the subscribers is required, the ringing switch RT at the calling station has to be displaced to the right into the position *g*. In this position the ringing circuit does not only pass over one particular contact which is closed transitorily on each rotation of the wiper, but the alternating ringing current is applied permanently to the common line GL. This alternating current then switches on the bells at all the branch stations in succession as soon as the wipers *dm* pass over the associated contacts. On account of the blocking devices connected in front of the speaking devices, intelligibility is not damaged even when ringing current is being transmitted. To terminate a collective call the ringing switch RT is restored to its original position.

In the arrangement shown in Fig. 2, which, so

far as the speaking and sending devices are concerned, corresponds with Fig. 1, the switches at the stations do not rotate continuously but are only connected to the common supply network on the initiation of a call. The construction of the switches as synchronous motors ensures the synchronous operation of all switches if these are connected up simultaneously at all the branch stations. The operation of the arrangement shown in Fig. 2 is as follows:

If the subscriber T1, for example, wishes to call the subscriber T4, then as in Fig. 1, he sets the selecting switch WT1 on contact 4. When the ringing switch RT1 is brought into the operating position, the circuit is completed for the alternating current from the supply network over the transformer Tr1 as follows: transformer Tr1, ringing switch RT1 in the operated position, wiper dm1a in the zero position, and now on the one hand over the start relay R1 and wiper dm1c and on the other hand in parallel therewith over the start relay R at all the other branch stations (for example R4 and dm4c at the station 4), wiper dm1b, (in the rest position), ringing switch RT1 (in the operating position) and back to transformer Tr1. In this circuit the start relays R are operated at all the branch stations and by way of their contacts (r1, r4, etc.) connect the associated synchronous motors (Dm1, Dm4, etc.) to the common network. All the synchronous motors start up and establish locking circuits over wipers (dm1d, dm4d, etc.) which, for example, are constructed as rotary off-normal contacts, which circuits are independent of the associated relays R during rotation. The start relays R are disconnected when the synchronous motors are set in operation and are reconnected after the completion of each rotation. If then alternating current is still flowing over the line, the synchronous motors remain connected.

When now the wiper dm1 passes to contact 4 at the calling station, a circuit is set up for the bell Wk4 of the wanted station in the same way as in Fig. 1. The bell operates transitorily each time the wiper occupies the associated segment. When the called party replies, ringing current is disconnected by throwing over the ringing switch RT1. The synchronous motors continue, for the time being, and on reaching the zero position, the relays R no longer energize on account of the absence of alternating ringing current and consequently the synchronous motors are disconnected and remain in the zero position.

If a collective call (conference call) is to be set up, the mode of operation is different from that of the system in Fig. 1. In this case, the selecting switch and not the ringing switch of the calling station is used to characterize a collective call in that a calling contact associated with the station itself is used, since that at the calling station is not otherwise required for calling. Thus, a special switching position of the ringing switch for collective calls is avoided. At the calling station T1, by setting the selecting switch WT1 on contact 1 (=contact g) a ringing circuit independent of the wipers dm1a and dm1b is prepared over the party line GL. As soon now as the ringing key RT1 is operated, alternating current flows permanently over the common line, as in Fig. 1, whereby on every rotation of the synchronous motor the bells at the various branch stations are operated suc-

cessively in the same way as has been described in connection with Fig. 1.

The system can alternatively be so arranged that when the selecting switch is set on a special contact for collective calls, the bells at all the branch stations are operated simultaneously to promote a collective call. In this case, it is necessary to feed all the bells simultaneously over the common line.

In systems according to Fig. 3, the synchronous motors are permanently connected to the station as in Fig. 1, but in this case the system is so arranged that the wipers of these switches do not rotate permanently but only during the period of selection so that the contacts traversed by these wipers are only little used. The other devices at the stations are fundamentally the same as in the arrangements according to Figs. 1 and 2.

The mode of operation is as follows:

If for example subscriber T1 wishes to call subscriber T4, alternating current is connected to the common line GL after the selecting switch WT1 has been set on contact 4 and after the ringing key RT1 has been operated. The alternating current is applied over the transformer Tr1 and over the wiper dm1a in the zero position. This alternating current does not only traverse the start relay R1 at the calling station arranged in bridge across the line, but in addition all the other parallel starting relays at the branch stations, for example R4. Through the energizing of the starting relays R, the coupling relays (K1, K4, etc.) at all the branch stations, are connected up to the transformers Tr in parallel with the rotary magnet. The coupling magnets couple the wipers (dm1, dm4, etc.) to the rotary magnets so that they traverse their associated contact banks synchronously at all the stations. When wiper dm1a reaches contact 4 of the wanted party, a circuit is completed for the wanted party's bell Wk4, in the same manner as already described apropos of Figs. 1 and 2. The bell Wk4 operates each time the associated contact is passed over. When the wanted party replies the ringing key RT1 at the calling station is restored to normal and disconnects the ringing current. On reaching the zero position, the start relays R can no longer energize, so that the coupling magnets are disconnected. The wipers at all stations are thus brought to rest in the zero position while the synchronous motors themselves continue to rotate continuously, under the influence of the alternating current from the supply network.

If a collective call is to be set up, the selecting switch WT1 is set on the contact 1 (=contact g) associated with the calling subscriber, for example T1. Over this contact, after the ringing key RT1 has been operated, alternating current is permanently connected to the common line, so that the bells at all the branch stations of the common line are operated in succession. If, however, it is desired to operate the bells at all the stations simultaneously for a conference call, a special calling contact for conference calls for example, contact 9, must be provided over which the bells at all the stations are operated simultaneously.

What is claimed is:

1. In combination with a telephone system comprising a party line serving a plurality of stations each having connected to said line a selecting device, a synchronous motor at each station for driving the selecting device at that sta-

tion, and an alternating current network serving said stations independently of said telephone line for operating said motors in synchronism.

2. In combination with a telephone system comprising a party line serving a plurality of stations each having connected to said line a selecting device, a synchronous motor at each station for driving the selecting device at that station, and an alternating current network serving said stations independently of said telephone line for operating said motors in synchronism, said motors being permanently connected to said network and operating continuously.

3. In a telephone system, a party line serving a plurality of stations, a selecting device at each of said stations connected to said line, an alternating current network serving said stations independently of said party line, a synchronous motor at each station operated continuously by current received over said network, and means at each station operable in one way to mechanically link the motor at that station to the selecting device thereat thereby to drive said selecting device and operable in another way to free the motor from the device thereby to permit the device to remain idle.

4. In a telephone system, a party line serving a plurality of stations, a selecting device at each of said stations connected to said line, a synchronous motor at each station for driving the selecting device thereat, an alternating current network serving said stations independently of said telephone line, means at each station for completing an operating circuit from said network to the motor at that station, and means at one of said stations for operating said last means at all of said stations simultaneously.

5. In combination, an alternating current network, a plurality of synchronous motors operated by current received over said network, a plurality of rotary switches driven in synchronism each by one of said motors, a signalling line common to said switches, a signal receiving device associated with each switch, said devices connected to said signalling line in turn by their associated switches, and means for impressing signalling current upon said line continuously thereby to operate said devices one after another.

6. In combination, an alternating current network, a plurality of synchronous motors operated by current received over said network, a plurality of rotary switches driven in synchronism each by one of said motors, a signalling line common to said switches, a signal receiving device associated with each switch, said devices connected to said signalling line in turn by their associated switches, means operated by current received over said network for impressing signalling current upon said line periodically and in synchronism with the connection of a particular device to said line, and variably operable selecting means for synchronizing the application of said signalling current with the connection to said line of any desired one of said devices.

7. In combination, an alternating current network, a plurality of synchronous motors operated by current received over said network, a plurality of multi-position switches driven in synchronism each by one of said motors, a signalling line common to said switches, selecting means associated with one of said switches, said selecting means adapted to be set variably to impress signalling current upon said line over the wipers of said one switch as said one switch passes through any desired position, and a plurality of signal receiving

devices associated with other ones of said switches, each of said devices being connected to the line over the wipers of a particular switch as that switch passes through a particular position.

8. In a telephone system, a party line serving a plurality of stations, a multi-position switch at each station, a device at each station connected to the line by the switch thereat when said switch occupies a particular position, the devices at the different stations being connected to said line in different positions of their associated switches, an alternating current network serving said stations independently of said party line, and a synchronous motor at each station operated by current received over said network, said motors driving the switches at said stations in synchronism.

9. In a telephone system, a party line serving a plurality of stations, a multi-position switch at each station, a device at each station connected to the line by the switch thereat when said switch occupies a particular position, the devices at the different stations being connected to said line in different positions of their associated switches, an alternating current network serving said stations, a synchronous motor at each station operated continuously by current received from said network, and means at all stations controlled in unison over the party line for mechanically linking the motors at the individual stations to the switches at the corresponding stations, thereby to initiate operation of said switches simultaneously.

10. In a telephone system, a party line serving a plurality of stations, a multi-position switch at each station, a device at each station connected to the line by the switch thereat when said switch occupies a particular position, the devices at the different stations being connected to said line in different positions of their associated switches, an alternating current network serving said stations, a synchronous motor at each station operated by current received over said network, said motors driving the switches at said stations in synchronism, and means at each station for impressing current upon said party line thereby to operate the devices at the other stations in turn as said devices are connected to said line by their associated switches.

11. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a device at each station connected to said party line by the switch at that station during a portion of the rotation of said switch, the connection of each device being out of phase with the connection of the other devices, and means at each station including the switch thereat for applying current to the party line concurrently with the connection to said party line of the device at any desired other station thereby periodically to actuate said device.

12. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operated continuously by current received over said network, means at all of said stations operated in unison from any of the stations to mechanically link the

motors at the individual stations to the corresponding switches thereby to drive said switches in synchronism, a device at each station connected to said party line by the switch at that station during a portion of the rotation of said switch, the connection of each device being out of phase with the connection of the other devices, and means at each station including the switch thereat for applying current to the party line concurrently with the connection to said party line of the device at any desired other station thereby periodically to actuate said device.

13. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a device at each station connected to said party line by the switch at that station during a portion of the rotation of said switch, the connection of each device being out of phase with the connection of the other devices, a selecting switch at one station, said selecting switch having a plurality of positions each corresponding to one of the other stations and effective when moved to a position corresponding to a particular station to cooperate with the rotary switch at said one station to apply current to the party line concurrently with the connection to said party line of the device at said particular station thereby periodically to actuate said last device.

14. A telephone system as claimed in claim 13, wherein said selecting switch also has a special position and is effective when moved to said special position to apply current to said party line continuously during one or more revolutions of said rotary switches thereby to actuate each device one or more times.

15. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a ringer at each station connected to said party line by the switch at that station during a portion of each revolution of said switch, the connection of each ringer being out of phase with the connection of the other ringers, and means for impressing ringing current upon said line continuously during one or more revolutions of said switches thereby to actuate each ringer one or more times.

16. A telephone system as claimed in claim

15, wherein said ringing current is alternating current derived from said network.

17. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a ringer at each station connected to said party line by the switch at that station during a portion of each revolution of said switch, the connection of each ringer being out of phase with the connection of the other ringers, and means at each station including the switch thereat for impressing ringing current upon said party line concurrently with the connection to said party line of the ringer at any desired other station thereby periodically to actuate said last ringer.

18. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a ringer at each station connected to said party line by the switch at that station during a portion of each revolution of said switch, the connection of each ringer being out of phase with the connection of the other ringers, and means at each station including the switch thereat for impressing alternating current derived from said network upon said party line concurrently with the connection to said party line of the ringer at any desired other station thereby periodically to actuate said last ringer.

19. In a telephone system, a party line serving a plurality of stations, an alternating current network serving said stations independently of said party line, a rotary switch at each station, synchronous motors at the stations operating over said alternating current network and driving said switches in synchronism, a ringer at each station connected to said party line by the switch at that station during a portion of each revolution of said switch, the connection of each ringer being out of phase with the connection of the other ringers, means for impressing alternating current derived from said network upon said party line to actuate one or more of said ringers, a filter at each station for blocking said derived alternating current, and talking instrumentalities at each station connected to the party line through said filter.

RICHARD URBAN.