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COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM

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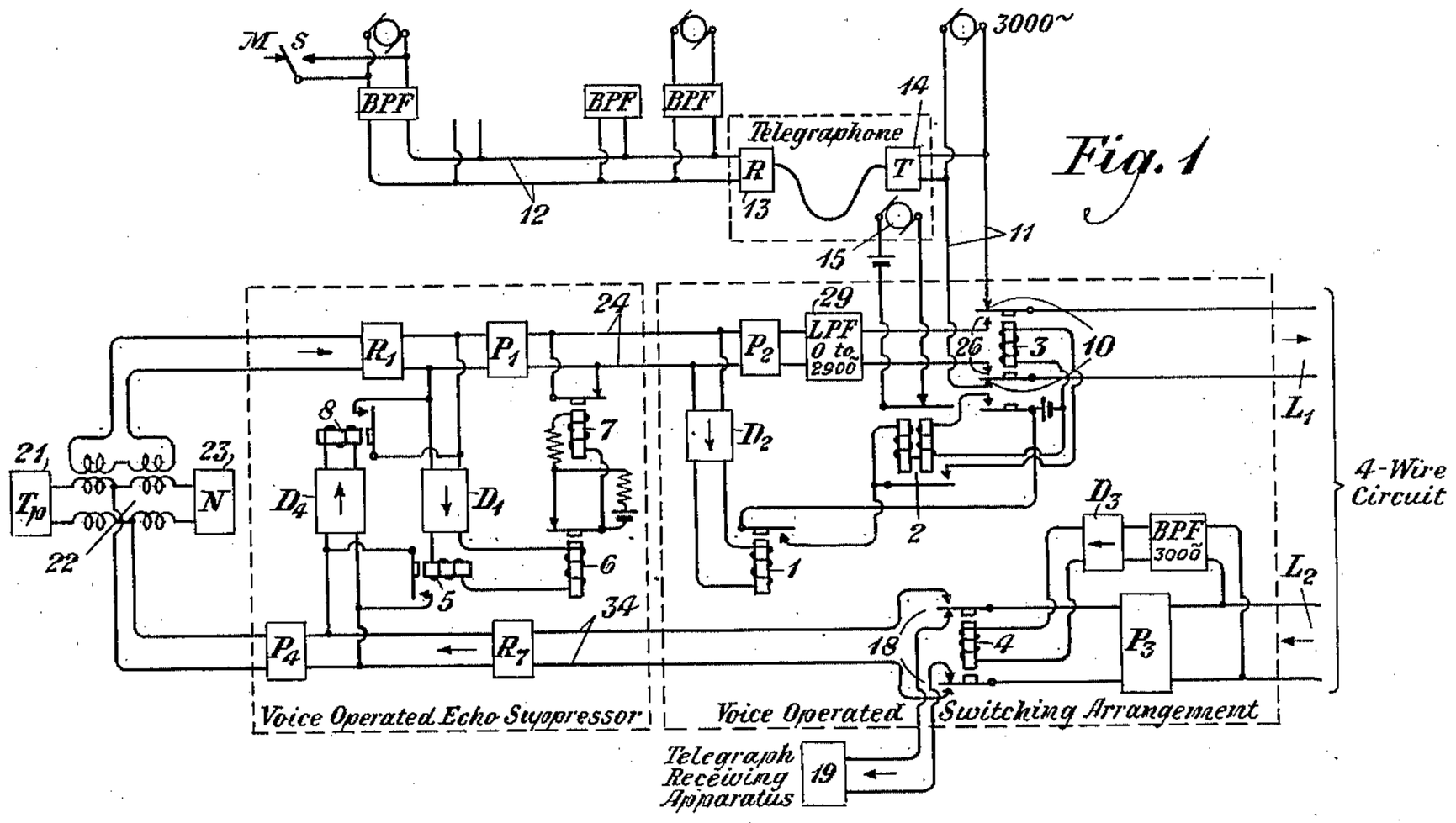

Fig. 1

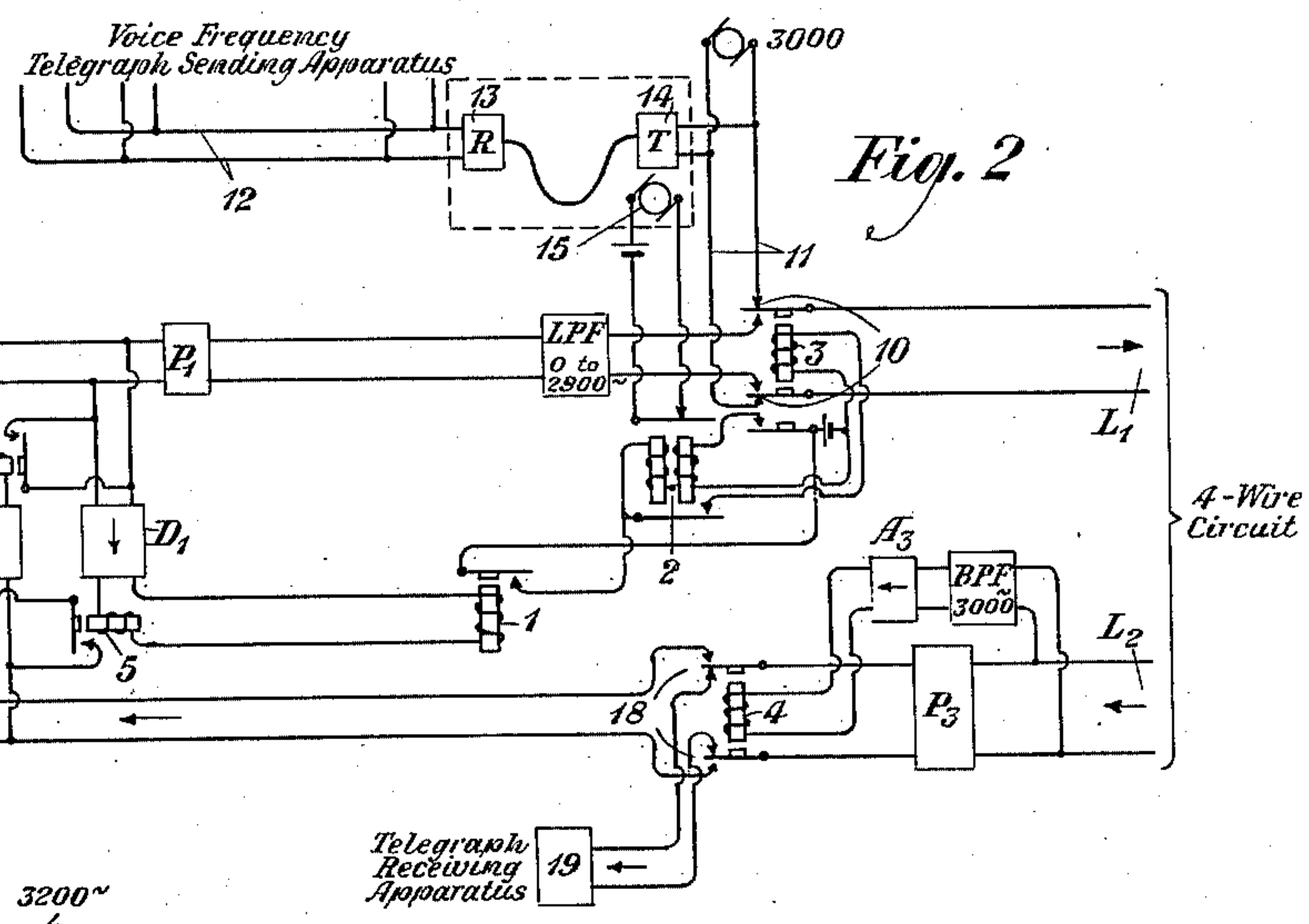

Fig. 2

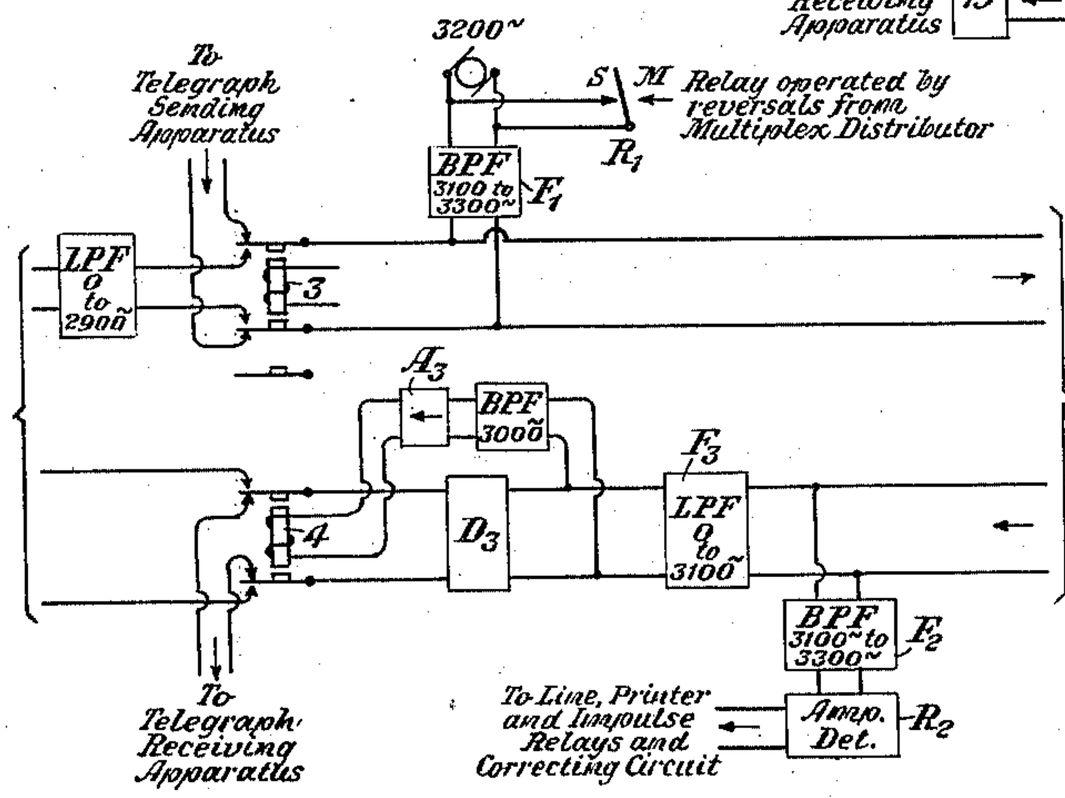

Fig. 3

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UNITED STATES PATENT OFFICE

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COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM

Application filed September 8, 1926. Serial No. 134,266.

This invention relates to a composite telephone and telegraph system and more particularly to a circuit arrangement by which a transmission line may be available for telephonic purposes at any time but will be in use for telegraphic purposes at other times.

In so-called composite telephone and telegraph circuits, it has been a common practice to use a line simultaneously for both purposes by having the two types of signals occupy different parts of the frequency spectrum. In this invention, we propose to use the relatively broad frequency band for both telephonic and telegraphic purposes, but it will be obvious that the two types of message cannot, in that case, be transmitted simultaneously. However, in all lines set aside for telephonic purposes, there are periods of greater or less duration when they are idle and it is the object of this invention to provide a circuit system by which the line is normally connected to the terminals of the telegraphic apparatus but is in condition to be connected to the terminals of the telephone apparatus whenever required for telephonic connection. By this arrangement, there is supplied effectively a full time telephone circuit and a part time telegraphic service over the same circuit within the same frequency range. This is a feature which is of special importance if the line is one which provides a relatively small amount of telephone business.

Another object of our invention is to provide for this transfer from the one type of signaling to the other automatically on arrival of telephonic messages and this we accomplish by the use of voice operated relays which are effective to make and maintain the telephonic connection during the necessary time but to restore the telegraphic connections on the cessation of the voice frequency currents in the telephone apparatus.

Other objects of the invention will be seen from the following specification which, taken with the accompanying drawing, illustrates certain ways of carrying out our invention.

In the drawing, Figure 1 shows the circuital arrangement for one end of a four wire transmission system, the other end being omitted for the reason that it is identical in connection and in operation. In this figure, the voice operated relay for performing the operations mentioned above is used for this purpose only. Fig. 2 is a modification of the circuit in which the desired operations are controlled by voice operated relays normally intended to function as echo suppressors and in this case performing both functions. Fig. 3 is still a further modification showing the use of a multiplex printing telegraph which carries with it certain requirements as to synchronous operation.

In all of the figures, we have shown the invention as applied to a four wire circuit in which the signals in one direction make use of one pair of wires and those in the other direction make use of the other pair of wires, and in each of the figures, as will appear later, the disassociation of the telegraph apparatus on one pair of wires in order that it may be used for telephone conversation does not affect the telegraph apparatus on the other pair of wires, so that while one party to a conversation is talking, telegraph signals may still be transmitted over the other pair of wires, this transmission being interrupted only when and while the other party carries on the conversation. Inasmuch as the initiation of telegraph signals will go on independently of the use of the line for telephonic purposes, it is necessary that storage facilities be provided by which telegraph messages may be accumulated and later sent out when the line becomes available, all of which will appear more clearly from the following description.

Referring particularly to Fig. 1, there is shown one end of a signaling system comprising the four-wire circuit made up of the pair L_1 and the pair L_2, the pair L_1 being indicated for transmission of signals to the remote station and the pair L_2 being indicated for reception of signals from that station. The line L_1 is normally connected by relay contacts 10 to the conductors 11 which latter are associated with suitable telegraph transmitting apparatus. While this apparatus may take on a large variety of forms, we have here shown it as being adapted for multiplex telegraphy

by using a plurality of alternating currents of different frequencies distributed throughout the speech signaling band, which may be taken as extending from about 100 cycles per second to 3000 cycles. It is quite practical, as is now well known in the art, to have as many as 15 or 20 telegraph channels distributed throughout this range. Such telegraph signals, from suitable sources and with suitable wave filters, are indicated as being impressed on the line 12 and arriving at a receiving device 13 where the message may be recorded in any suitable way for subsequent transmission. In this case, the drawing indicates that the record would be made on a telegraphone wire and that retransmission occurs from the transmitter 14 which feeds into the line 11. The operation of this transmitter 14 may be maintained by a motor 15 which in turn is controlled by suitable relays to stop or start under the proper conditions.

Telegraph signals coming in on the line L_2 pass directly through contacts 18 to appropriate telegraph receiving apparatus 19.

The connections thus far described are the ones normally existing and under these conditions telegraph messages may be transmitted or received without special regard to other apparatus. However, in addition to the above there is provided the necessary telephone apparatus to constitute the now well-known four-wire telephone circuit. This consists of a local transmission line or subscriber's station 21 connected to a hybrid coil 22, which hybrid coil has also connected with it the balancing network 23. The series winding of the hybrid coil 22 may pass through a repeater R_1 from whence it continues over the line 24 through various pieces of apparatus to the terminals 26 of the relay 3 by which it may be associated with the line L_1. Bridged across the line 24 is the detector D_2 adapted upon the receipt of telephone currents to operate the relay 1 which in turn operates the relays 2 and 3. The operation of the relay 3 transfers the line L_1 from the telegraph transmitting apparatus to the telephone transmitting apparatus and the operation of the relay 2 opens the circuit for the motor 15, whereupon the telegraph transmitter 14 ceases to function. It will thus be seen that the one pair of wires L_1 is connected for telephone transmission so far as the one end of the line is concerned but it will be borne in mind that at the other end of L_1 there is associated telegraph receiving apparatus of the kind indicated by 19, this receiving apparatus being maintained in connection with the line by contacts corresponding to the contacts 18. It is necessary that provision be made for normally maintaining the association of the telegraph receiving apparatus to the line but these means should be such as to release or disconnect this apparatus as soon as the relay 3 has been operated and to connect the telephone receiving apparatus. To this end, we provide at the telegraph transmitting station a source of alternating current of a frequency different from that used in the telegraph channels. In the figure, this has been indicated as 3,000 cycles. Normally, this 3,000 cycle current passes over the line and is received at the further end through a by-pass circuit comprising a band pass filter, illustrated here for this 3,000 cycle current, and a detector D_3, in the output circuit of which there is contained the relay 4. As long as this 3,000 cycle current is on the line, the relay 4 will be excited to maintain the telegraph receiving apparatus 19 associated with the line but upon the operation of relay 3, this 3,000 cycle current ceases and immediately the relay 4 is released to connect the receiving side of the telephone circuit to the line. This is shown clearly in the lower portion of Fig. 1, but it is to be understood that the description just given relates to the corresponding apparatus at the further end of the line L_1. Thus, it is seen that an incoming voice current from the subscriber station 21 will automatically disconnect the telegraph transmitting and receiving apparatus from the line L_1 and associate with it telephone apparatus which will permit conversation in the one direction only.

A similar arrangement is used for the other side of the circuit so that telephone transmission may take place in the opposite direction, but it should be observed specifically that although the line L_1 may be preempted for a time for telephone purposes, the line L_2 may still be transmitting telegraph messages.

It will be observed that relay 2 has a locking-up feature to maintain proper sequence of operation, on closing this being in the order 1, 2, 3 and on opening this being 1, 3, 2.

Various additional features will ordinarily be used with this circuit in order to give more satisfactory operation. For example, one might associate with the system the now well known voice operated echo suppressors of the kind described in patent to Mills, No. 1,434,790, dated November 7, 1922. Such an echo suppressor may consist of a detector D_1 bridged across the line 24 and a similar detector D_4 bridged across the line 34. Voice currents coming from 21 will pass through the detector D_1 and operate the relay 5 to short-circuit the line 34 and also the detector D_4. They will also operate the relay 6 which in turn operates the relay 7 to remove a short circuit across the line 24, this short circuit being provided to prevent the well known phenomenon of singing. Similarly, voice current coming in over the line L_2 will pass into the detector D_4 and through it operate the relay 8 to short-circuit the line 24 and the detector D_1.

In connection with such voice operated re-

lays, wherever they may occur, there will always be a certain delay and it is desirable that the transmission of the telephone signaling should be postponed sufficiently to permit the operation of these relays. The delay devices for performing this function take on a variety of forms and they are here indicated schematically only by P_1, P_2, P_3 and P_4.

In order that the relay 4 at the remote end of line L_1 shall not be operated by 3,000 cycle current emanating from the station 21, there is shown a low pass filter 29 with a cut-off at some suitable point such as 2900 which will still permit the transmission of the essential voice frequencies but will not permit the passage of a frequency to which the relay 4 is sensitive.

Fig. 2 is a circuit which is essentially the same as Fig. 1 but in which the function of the detector D_2 is performed by one in the voice operated echo suppressor, in particular, the detector D_1. Upon receipt of telephone signals from 21, detector D_1 will operate the relay 5 in the usual manner and at the same time will operate the relay 1 to perform the same function as the relay 1 of Fig. 1, it will be noted that at the same time this relay 1, with 3, serves the same purpose as relay 6, with relay 7, of Fig. 1.

It will be noted in connection with Fig. 1 that the operation of the echo suppressors is quite independent of the remainder of the circuit and, if desired, these may be omitted without effecting the circuit comprising our invention.

If it is desired to use the telegraph circuit described in Figs. 1 and 2 for multiplex printing telegraphy, the arrangement already described must be modified in order to maintain the synchronism of the distributors, for it is evident that in the above arrangement, when the four-wire circuit is used for telephony, the synchronism of the multiplex system is interrupted and there is no assurance that when the circuit is again used for telegraphy, the receiving distributor will be in the correct position for the proper distribution of the received printer signals. This difficulty is avoided by the arrangement of Fig. 3, in which only those portions of the circuit are shown which are concerned with the modification. Instead of synchronizing the distributors, by means of the received printer signals, as is usual in the ordinary multiplex printing telegraph system, synchronism is here maintained over a separate channel outside of the voice frequency range. This synchronizing channel, operating at, say, 3200 cycles, is bridged on the transmitting side of the four-wire circuit through the band pass filter F_1 and on the receiving side of the four-wire circuit through the band pass filter F_2. A low pass filter F_3 is used on the receiving side of the four-wire circuit so that the synchronizing current will not interfere with the telephone or telegraph currents. The sending distributor, by means of an added ring of segments, sends steady reversals to the sending relay R_1, thus transmitting 3200 cycle pulses over the synchronizing channel to the receiving amplifier detector R_2, these received pulses giving steady reversals to the synchronizing line relay to which the correcting circuit is connected in the usual manner. Thus synchronism of the printer signals is maintained regardless of the position of the switching relays 3 and 4 and of the use being made of the four-wire circuit in the voice frequency range.

While this invention has been described specifically in connection with a four-wire line, it should be understood that it applies to any system using two two-way channels, such as a radio system with a transmitting and a receiving station at each terminal or to a two two-way system made up in part of four wires and in part of radio channels and the expression "four-channel transmission line" is understood to cover any of these.

What is claimed is:

1. In a signaling system comprising a transmission line, telegraph apparatus associated with each end thereof, telephone apparatus adapted to be associated therewith, and means for automatically disconnecting the telegraph apparatus and connecting the telephone apparatus on the arrival of telephone currents and a special frequency signaling means at one end of the line to maintain the telegraph apparatus at the other end associated with the line during absence of telephone currents.

2. In a signaling system comprising a transmission line, telegraph apparatus and telephone apparatus adapted to be associated with each end thereof, means for normally maintaining the telegraph apparatus in association with said line, and means controlled by telephone currents to disconnect the telegraph apparatus and connect the telephone apparatus, and means associated with the telegraph apparatus to store up telegraph message while the said apparatus is disconnected from the line.

3. In a signaling system comprising a transmission line, telegraph apparatus and teelphone apparatus adapted to be associated with each end thereof, a relay for normally maintaining the telegraph apparatus in association with said line, and a voice-operated relay controlled by telephone currents to disconnect the telegraph apparatus and connect the telephone apparatus and a signaling means associated with the transmitting telegraph apparatus at each end to maintain the receiving telegraph apparatus at the other end associated with the line during absence of telephone currents.

4. In a signaling system comprising a transmission line, telegraph apparatus and telephone apparatus adapted to be associated

with each end thereof, a relay for normally maintaining the telegraph apparatus in association with said line, a voice-operated relay controlled by telephone currents to disconnect the telegraph apparatus and connect the telephone apparatus, and means associated with the telegraph apparatus to store up telegraph message while the said apparatus is disconnected from the line.

5. In a signaling system comprising a four-channel transmission line, signaling apparatus at one end thereof comprising telegraph transmitting apparatus and telephone transmitting apparatus adapted to be associated with one pair of said channels and telegraph receiving apparatus and telephone receiving apparatus adapted to be associated with the other end of said pair, means for normally maintaining the transmitting telegraph apparatus in association with said pairs of channels, means controlled by the transmitting telegraph apparatus to maintain the receiving telegraph apparatus associated with the line during absence of telephone currents, and means controlled by telephone currents to disconnect the telegraph apparatus and connect the telephone apparatus.

6. In a signaling system comprising a four-wire transmission line, signaling apparatus at one end thereof comprising telegraph transmitting apparatus and telephone transmitting apparatus adapted to be associated with one pair of said wires, and telegraph receiving apparatus and telephone receiving apparatus adapted to be associated with the other end of said pair, and means for automatically disconnecting the transmitting telegraph apparatus and connecting the telephone apparatus, said means being operated by voice currents and a special frequency signaling means at each end of the line to maintain the receiving telegraph apparatus at the other end associated with the line during absence of telephone currents.

7. In a signaling system comprising a four-wire transmission line, signaling apparatus at one end thereof comprising telegraph transmitting apparatus and telephone transmitting apparatus adapted to be associated with one pair of said wires, and telegraph receiving apparatus and telephone receiving apparatus adapted to be associated with the other end of said pair, means for automatically disconnecting the telegraph apparatus and connecting the telephone apparatus, said means being operated by voice currents, and means associated with the telegraph apparatus to store up telegraph message while the said apparatus is disconnected from the line.

8. A four-wire telephone transmission line comprising terminal telephone apparatus, telegraph transmitting apparatus adapted to be associated with one pair of wires for transmission in the direction of the telephone currents, similar apparatus associated with the other pair for transmission in the other direction, voice-operated relays on each pair of lines to disconnect the telegraph apparatus from that line over which telephone current is passing, and means associated with the telegraph transmitting apparatus at each terminal to store up telegraph message while the said apparatus is disconnected from the line.

9. In a signaling system comprising a transmission line, telegraph apparatus associated with each end thereof and adapted to signal in the telephone frequency range, telephone apparatus adapted to be associated with said line and means for automatically disconnecting the telegraph apparatus and connecting the telephone apparatus on arrival of telephone currents.

10. In a signaling system comprising a transmission line, telegraph apparatus associated with each end thereof and adapted for multiplex telegraph signaling in the telephone frequency range, telephone apparatus adapted to be associated with the line and means for automatically disconnecting the telegraph apparatus and connecting the telephone apparatus on arrival of telephone currents.

11. In a signaling system comprising a transmission line, synchronous multiplex telegraph signaling apparatus associated with each end thereof and adapted to signal in the telephone frequency range, telephone apparatus adapted to be associated with the line and means for disconnecting the telegraph apparatus and connecting the telephone apparatus on arrival of telephone currents, and a supplementary synchronizing signaling means operating outside the telephone frequency range for maintaining synchronism between the telegraph transmitting apparatus and its corresponding receiving apparatus.

12. In a signaling system comprising a transmission line, the method of transmission of telegraph and telephone messages over the same channel and in the same frequency range, which consists in maintaining the telegraph apparatus normally in connection with the line for transmission of telegraph signals in the telephone frequency range, disconnecting the telegraph apparatus and connecting the telephone apparatus on the arrival of the telephone current and by means of the telephone current, and maintaining said telephone connection only while telephone current is arriving.

13. In a signaling system comprising a transmission line, the method of transmission of telegraph and telephone messages over the same channel, which consists in maintaining the telegraph apparatus normally in connection with the line for transmission of telegraph signals, disconnecting the telegraph apparatus and connecting the telephone apparatus on the arrival of the tele-

phone current and by means of the telephone current, maintaining said telephone connection only while telephone current is arriving, and storing up telegraph messages during the use of the line for telephony.

In testimony whereof, we have signed our names to this specification this 7th day of September, 1926.

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