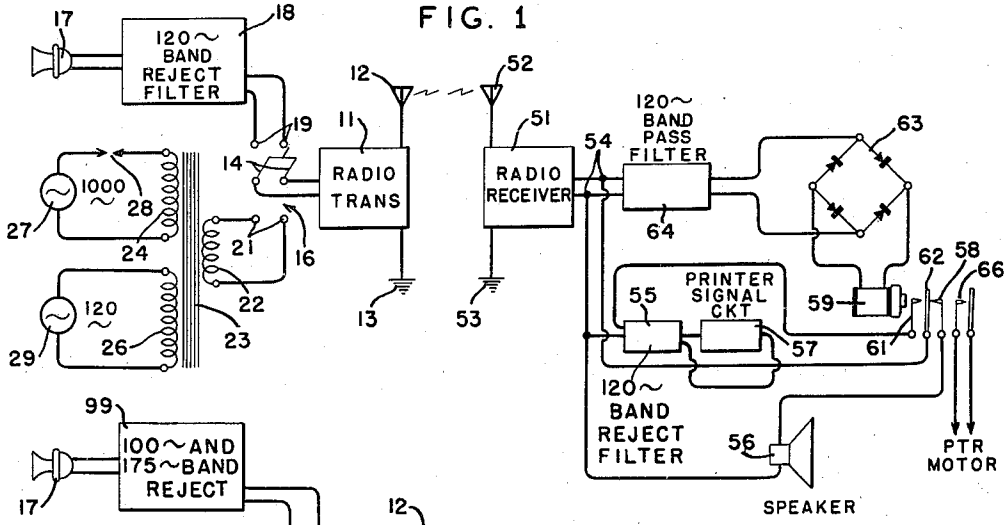
Sept. 2, 1941. R. E. ZENNER 2,254,342

RECEIVER SELECTION SYSTEM

Filed Nov. 2, 1939 2 Sheets-Sheet 1

FIG. 1



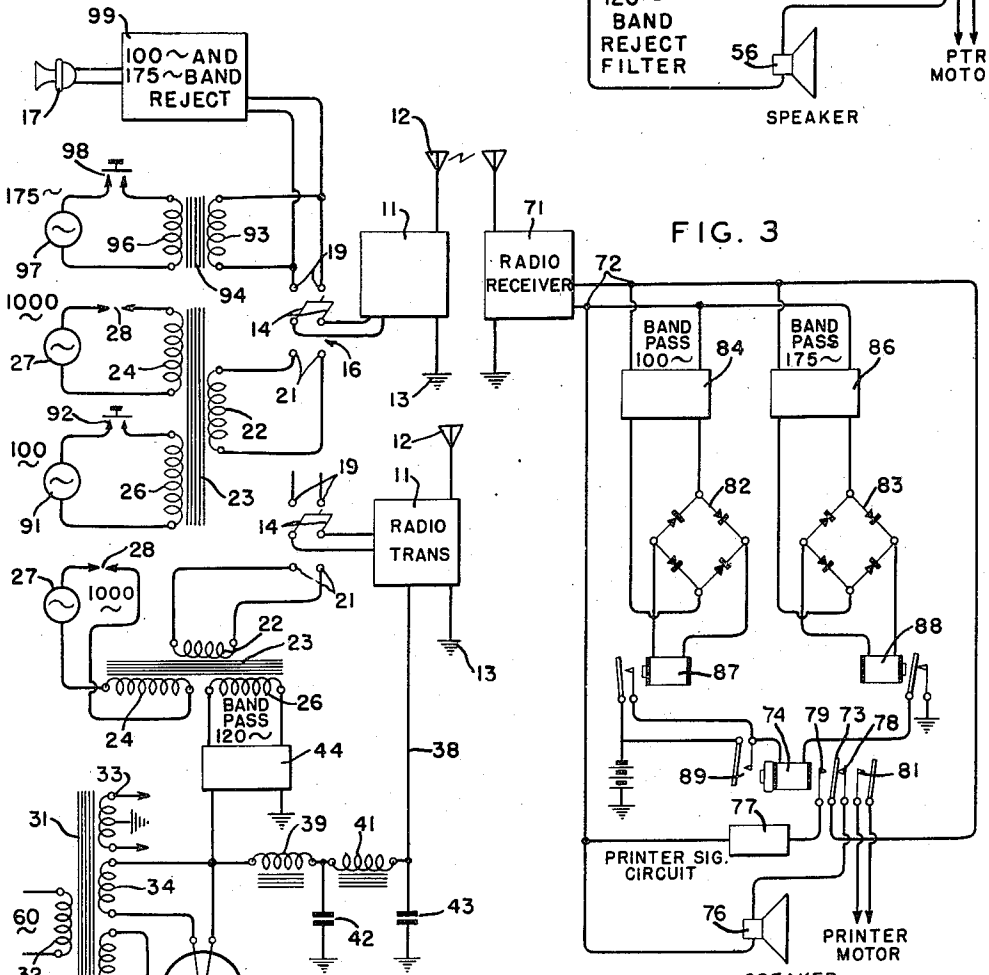


FIG. 3

FIG. 2

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FIG. 5

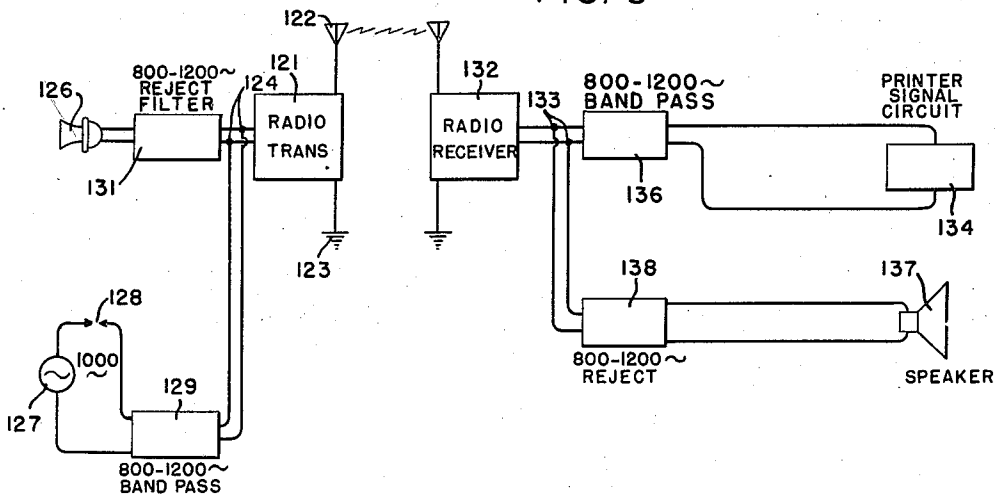
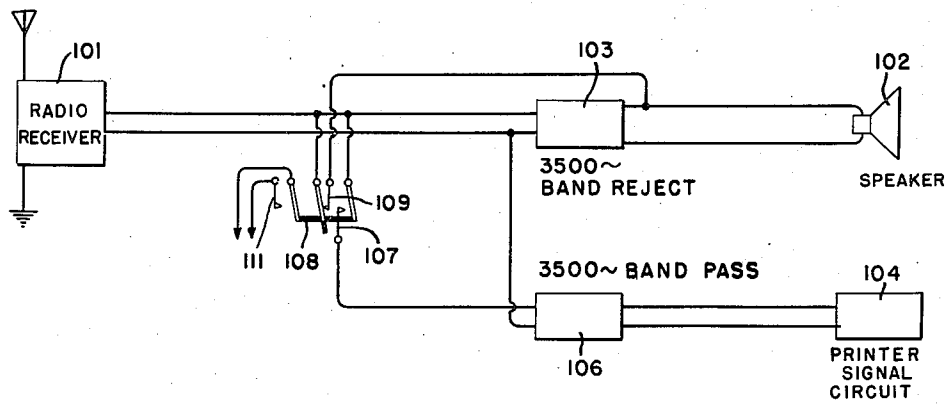


FIG. 4



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Patented Sept. 2, 1941 2,254,342

UNITED STATES PATENT OFFICE

2,254,342

RECEIVER SELECTION SYSTEM

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Application November 2, 1939, Serial No. 302,549

25 Claims. (Cl. 179—4)

This invention relates to communication systems and particularly to composite systems for the transmission and reception of two or more different kinds of message communicating media, such as voice and telegraph signals, over a single communication circuit.

The invention exhibits outstanding utility in the transmission of messages through space by means of radiant energy, although it may be employed in systems wherein the transmitting and receiving stations are interconnected by metallic conductive lines.

An object of the invention is to channel the different types of message communicating media to their respective receiving devices at the receiving station either manually or automatically.

Another object of the invention is to transmit simultaneously two or more message media over a single communication channel from a single transmitting station and to receive and channel said message media automatically to their respective receiving devices.

The invention features signal transmitting and receiving apparatus associated with a communication channel including means for transmitting, along with message signals, a special signal which controls a selecting device at the receiving station for selecting and setting in operation the particular signal receiving device for which the message signals are intended.

According to one embodiment of the invention, there is provided at the transmitting station a transmitting device, such as a radio transmitter, to the signal input circuit of which may be connected alternatively a speech input device or a telegraph transmitter. Associated with the telegraph transmitter is a special signal generating device which continuously applies the special signal to the radio transmitter when the telegraph transmitter is connected thereto. At the receiving station, there is a radio receiver to the output circuit of which is connected a receiving device responsive to the special signal which accompanies telegraph signals. The receiving device controls a switching mechanism which alternatively connects to the output circuit of the radio receiver, the signal circuit of a printing telegraph apparatus or a speech reproducer. The switching device includes contacts for closing the circuit of the operating motor for the printer, so that the printer motor will operate when and only when the telegraph signal transmitter is connected to the radio transmitter.

According to another embodiment of the invention, the receiving apparatus is provided with two selectors for the receiving devices, one being responsive to one special signal and the other being responsive to a different special signal. Upon reception of one of the special signals, the printing telegraph apparatus is selected for operation and its motor circuit is closed and in response to the other special signal, the printing telegraph apparatus is disconnected from the radio receiver, its motor circuit is opened, and the speech reproducer is connected to the radio receiver.

According to another embodiment of the invention, the switching from one to the other of the two receiving devices; namely, the printer and the speech reproducer, is accomplished by a manually operable switch and only printing telegraph signals or speech signals are transmitted and received. The mode of operation of this may be to keep the switch positioned normally to receive speech, and when telegraph signals are heard in the speech reproducer the switch to the printer may be made, thereby barring telegraph signals from the speech reproducer, but retaining it in condition to receive speech signals which may be transmitted simultaneously with telegraph signals.

According to still another embodiment of the invention, the speech input device and the telegraph signal transmitter are both permanently connected to the input circuit of the radio transmitter at the sending station and both may be operated simultaneously. At the receiving station, the printer signal circuit and the speech reproducer circuit are both permanently connected to the output circuit of the radio receiver and will operate simultaneously to print the message intended for the printer and conveyed by telegraph signals and to reproduce through the speaker the voice message impressed upon the speech input device of the transmitter.

For a complete understanding of the invention, reference may be had to the following detailed description to be interpreted in the light of the accompanying drawings, wherein

Fig. 1 is a view showing in diagrammatic form a transmitting system and a receiving system according to one embodiment of the invention in which speech or telegraph signal devices may be connected to a transmitter alternatively to control corresponding receiving devices in a receiving station under the selective control of a device responsive to a special signal;

Fig. 2 is a view showing in diagrammatic form one system for generating the special signal used in the system according to Fig. 1;

Fig. 3 is a view in diagrammatic form showing a transmitter having two control signal transmitters and a receiving system having a receiver selecting system responsive to one or the other of two special signals;

Fig. 4 is a view in diagrammatic form showing a receiving system in which the channeling of voice or telegraph code signals to their respective receiving devices is manual; and

Fig. 5 is a view in diagrammatic form showing a transmitting and receiving system in which a voice transmitter and telegraph code transmitter may be operated simultaneously, working into one radio transmitter, and at the receiving station a telegraph receiver and a speech reproducer may be operated from one radio receiver to respond simultaneously to their respective signals without switching operations.

Referring now to the drawings, and particularly to Fig. 1, the reference numeral 11 indicates a radio transmitter which may be of any desired form and which has its output circuit connected to the transmitting antenna 12 and the ground 13. The input circuit of the radio transmitter 11 is connected to the contact blades 14 of a double throw switch indicated generally at 16. A speech input system comprising a microphone 17 and any necessary batteries and amplifier which may be required in connection therewith is connected across one pair of terminals of the switch 16 through a band reject filter 18 which will filter from speech frequencies impressed upon microphone 17 a predetermined frequency, which in the present embodiment of the invention may be assumed to be one hundred twenty cycles per second, oscillations of this frequency being trapped in the filter and all other speech frequencies being passed through the filter without material attenuation. The terminals of switch 16 to which the speech input system is connected are designated by the reference numeral 19.

To the other pair of terminals 21 of switch 16 is connected the secondary winding 22 of an iron core transformer 23. Transformer 23 has two primary windings 24 and 26. Connected in series with the primary winding 24 are an audible frequency tone generator 27 and the contacts 28 of a telegraph signal transmitter. The tone generator 27 furnishes the telegraph signaling current which is to be applied to the input of radio transmitter 11 and a satisfactory frequency for this signaling current is one thousand cycles per second.

The telegraph transmitter, which is represented symbolically by the contacts 28, is preferably of the kind which generates facsimile telegraph signals and may be controlled by keyboard or perforated tape. Examples of facsimile telegraph signal transmitters which may be employed for controlling the application of the one thousand-cycle tone to transformer primary 24 according to facsimile codes are shown in Patent 2,046,328, granted July 7, 1936, to E. E. Kleinschmidt et al. Upon each closure of the contacts 28, as a character signal is transmitted, oscillating current from the one thousand-cycle generator 27 traverses transformer primary 24 and corresponding oscillations occur in the secondary 22.

Transformer primary 26 has connected to the terminals thereof a low frequency tone generator 29 for impressing upon the primary winding 26 a special control signal. One hundred and twenty cycles per second is a convenient frequency for this special signal, this frequency being readily available in the power supply of the radio transmitter as will now be described.

Referring to Fig. 2, the radio transmitter 11 requires a power supply for converting the commercially available sixty-cycle alternating current to high voltage direct current for the plates and certain other elements of the electron tubes in the transmitter. The reference numeral 31 designates a power transformer, the primary winding 32 of which may be connected to a commercially available source of alternating current at a frequency of sixty cycles per second. Transformer 31 has a low voltage secondary 33 for supplying current for operating the filaments or heaters of the electron tubes in the radio transmitter 11, a low voltage secondary winding 34 for operating the filament of full wave rectifier electron tube 36, and a high voltage secondary winding 37 for supplying the high voltage to be converted by rectification into the D. C. voltage required for the plates of the electron tubes in the transmitter. The free ends of transformer secondary winding 37 are connected to the plates of the rectifier tube 36 and a midpoint of the winding is connected to ground. As is well understood, the grounded center point of transformer winding 37 is the low voltage point and the filament of the tube, which serves as a cathode, is the high voltage point. A conductor 38, by which high voltage direct current is supplied to the radio transmitter is connected through chokes 39 and 41 to the filament of rectifier tube 36. Condensers 42 and 43 are connected between ground and an end of each of the chokes 39 and 41 and the network which comprises the chokes and the condensers serves as a filter to by-pass to ground the oscillating component of the rectified voltage and thus to supply a pure D. C. voltage to the high voltage conductor 38. This power supply, rectifier, and filter arrangement is well known in radio transmitters and receivers.

At the output of the rectifier, which is represented by the grounded center tap of secondary winding 37 and the filament of the rectifier tube 36, there appears a component frequency which is double that applied to the primary winding 32, or one hundred twenty cycles per second. This component may be employed as the special signal to be applied to the primary winding 26 of transformer 23 by connecting the secondary to ground and to the filament of rectifier tube 36 through a band pass filter 44 which will pass alternating current at one hundred twenty cycles per second and attenuate current at all other frequencies. Thus, a source of alternating current at a frequency of one hundred twenty cycles per second is readily available in the power supply of the radio transmitter for use as the special signal to be applied between the terminals of transformer primary 26.

The operation of the transmitting station portion of the apparatus shown in Fig. 1 is as follows: When it is desired to transmit speech, the blades 14 of switch 16 are placed in contact with the terminals 19. This connects the microphone input circuit to the radio transmitter 11, which is placed in operation to generate its carrier frequency. A message may then be spoken into microphone 17 and the speech frequency generated therein will modulate the carrier frequency of the radio transmitter 11 and the modulated carrier frequency will be radiated from transmitting antenna 12. The filter 18 in the

speech input circuit attenuates speech frequencies of one hundred twenty cycles per second so that those speech frequencies do not appear in the modulated carrier wave. The purpose of this is to prevent frequencies of one hundred twenty cycles per second which may appear in normal speech from actuating that receiving device at the receiving station which the special signals generated at tone generator 29 are intended to operate when facsimile telegraph signals are being transmitted.

When telegraph signals are to be transmitted, the switch blades 14 are moved out of engagement with terminals 19 and into engagement with terminals 21. Immediately the special signal generated at 29 is impressed upon the input circuit of the radio transmitter 11 and the carrier frequency of the transmitter is modulated by the one hundred twenty cycle special signal. The modulated carrier wave is radiated from transmitting antenna 12 in the same manner as the speech modulated carrier was radiated. The special one hundred twenty cycle signal continues to be impressed upon the input circuit of the transmitter as long as switch blades 14 engage terminals 21.

The transmission of facsimile telegraph signals is accomplished by the closing and reopening of the contacts 28 according to the codes of the characters to be transmitted. Upon each closure of the contact, a train of one thousand cycle waves is impressed upon the input circuit of the radio transmitter 11, and upon the reopening of the contacts the train of waves is interrupted. Each character is represented by a series of separated trains of one thousand cycle waves, the length of each train and the lengths of the intervals between trains determining the character being transmitted. Each train of waves at one thousand cycles per second modulates the carrier frequency of the radio transmitter in the same manner as does the special signal at one hundred twenty cycles, so that the signal radiated from the transmitting antenna 12 is a complex wave consisting of the carrier frequency continuously modulated at one hundred twenty cycles per second and intermittently modulated by trains of waves at one thousand cycles per second.

At the receiving station shown in Fig. 1, there is a radio receiver 51 having its input circuit connected to receiving antenna 52 and to ground at 53. Radio receiver 51 receives the modulated carrier wave from transmitter 11, demodulates the carrier wave, amplifies the resulting signal and impresses it upon its output circuit, which is represented in Fig. 1 by the output terminals 54. The signals appearing at the terminals 54 may be the speech frequencies which were generated in the microphone 17 or they may be the complex wave comprising the continuous one hundred twenty cycle special signal and the intermittent one thousand cycle signal corresponding to the waves induced in the secondary winding 22 of transformer 23 in the transmitter.

To one of the receiver output terminals 54 are connected one end of the voice coil of a speech reproducer 56 and one end of a printer signal circuit indicated symbolically at 57. The other end of the voice coil of the speech reproducer is connected to a back contact 58 of a relay 59 and the other end of the printer signal circuit is connected to the front contact 61 of the relay. The other of the output terminals 54 of the radio receiver is connected to the contact tongue 62 which is engageable with either of the contacts 58 and 61. Also connected to the output terminals 54 of the radio receiver are the input terminals of a bridge rectifier device 63, the output terminals of which are connected to the winding of relay 59. A one hundred twenty cycle band pass filter 64 is connected between the output terminals 54 of the radio receiver and the input terminals of rectifier 63 for attenuating current at all frequencies except one hundred twenty cycles per second, which is the frequency of the special signal. Relay 59 is energized by direct current resulting from the rectification at 63 of the one hundred twenty cycle special signal.

Relay 59 is preferably slow to operate in order that it shall not respond to any brief one hundred twenty cycle wave which might appear in a speech wave, although this is extremely unlikely due to the employment of filter 18 in the speech input circuit of the radio transmitter. Thus, relay 59 will be energized only when the transmitting station switch 16 is positioned for the transmission of facsimile telegraph signals and, upon being so energized, it will attract contact tongue 62 into engagement with contact 61 thereby connecting the printer signal circuit 57 across the output terminals 54 of the radio receiver. Relay 59 also has a contact pair 66 which upon energization of the relay become engaged to close the circuit for the operating motor of the facsimile printer and thus place the printer in condition to record characters corresponding to the signals received. When the radio transmitter 11 is disconnected from the printer signal transmitter terminals 21, the special signal tone of one hundred twenty cycles ceases and no voltage is impressed across the input terminals of rectifier 63. Relay 59 thereupon becomes de-energized and its contact tongue 62 falls away into engagement with contacts 58, thus disconnecting the printer signal circuit from the radio receiver and connecting thereto the speech reproducer 56 and also the contacts 66 open, thus disconnecting power from the printer operating motor. The receiving system is now conditioned to receive speech signals, and the relay 59 will not be energized during the reception of speech signals due to the removal from speech frequencies of oscillations at one hundred twenty cycles per second by the band reject filter 18.

The hereinbefore identified patent to E. E. Kleinschmidt et al. discloses a facsimile printer which may be included in the printer signal circuit 57 for recording characters corresponding to the facsimile signals transmitted from the transmitting contact 28. Such a printer operates upon pulses of direct current. Since the printer controlling signals appear at the output terminals 54 of radio receiver 51 as trains of alternating current at a frequency of one thousand cycles per second, the printer signal circuit 57 may be assumed to include a rectifier similar to the rectifier 63 for converting each train of one thousand cycle oscillations into a direct current impulse. The printer signal circuit 57 may also require a one hundred twenty cycle band reject filter 55, similar to the filter 18, in order to prevent the one hundred twenty cycle control signal from reaching the rectifier in the printer signal circuit and being rectified to cause undesired marks characteristic of the one hundred twenty cycle wave to be recorded by the printer.

In Fig. 3 is shown a modified receiving station for receiving speech or facsimile printer signals. It includes a radio receiver 71 which may be identical with the radio receiver 51 shown in Fig.

1, and which has its input circuit connected to receiving antenna and ground. To its output terminals 72 are similarly connected a contact tongue 73 of a slow-to-operate and slow-to-release relay 74 and one end of the voice coil circuit of a speech reproducer 76 and of a printer signal circuit 77. The other end of the voice coil and printer signal circuit are connected respectively to the back and front contacts 78 and 79 of relay 74, as in Fig. 1. Relay 74 also has contacts 81 for closing the printer motor circuit upon energization of the relay. The circuit of Fig. 3 differs from the receiving circuit of Fig. 1 in the manner of controlling the relay 74. The input circuits of two bridge rectifiers 82 and 83 are connected across the output terminals 72 of radio receiver 71, a band pass filter for one control signal frequency, such as one hundred cycles per second, represented by the reference numeral 84 being interposed between the terminals 72 of the radio receiver and a rectifier 82, and a band pass filter for another control signal frequency, such as one hundred seventy-five cycles per second, indicated 86 being connected between output terminals 72 and the other rectifier 83. A relay 87 is connected across the output terminals of rectifier 82 and the relay has one contact tongue connected to grounded battery and a front contact connected to one end of the winding of relay 74. The winding of relay 88 has a single contact tongue which is connected to the other end of the winding of relay 74 and a single back contact which is connected to ground. Relay 74 is also provided with holding contacts 89, one of which is connected directly to battery and the other is connected directly to the winding of relay 74 for shunting the contacts of relay 87 when relay 74 has become energized, and connecting battery directly to the winding thereof.

When a control signal frequency of one hundred cycles per second appears at output terminals 72 of radio receiver 71, it passes through filter 84 to the input terminals of rectifier 82 and is rectified to produce direct current which energizes relay 87. The same signal is attenuated in filter 86 and, therefore, does not affect rectifier 33. Upon energization of relay 87, its contact tongue engages its front contact to connect battery to one end of the winding of relay 74, the other end of which is connected to ground through the contact tongue and back contact of de-energized relay 88. Relay 74 is slow operating in order that it shall not become energized in response to transient frequencies of one hundred cycles per second which might appear in received speech frequencies. Upon the energization of relay 74, its contacts 89 become closed to establish a holding circuit whereupon relay 87 need remain energized no longer and the transmission of the one hundred cycle special signal may be stopped. Relay 74 will remain energized until such time as a special signal at a frequency of one hundred seventy-five cycles per second appears at the radio receiver terminals 72. Current at this frequency will pass through filter 86 to the input terminals of rectifier 83, but will be rejected by filter 84. The one hundred seventy-five cycle special signal will be rectified to produce energizing current for relay 88 which will attract its contact tongue out of engagement with its back contact, thereby removing ground connection from the winding of relay 74 which will become de-energized. The control of the speech reproducer circuit and the printer signal circuit by relay 74 is the same as in Fig. 1. The speech reproducer is connected to the terminals of the radio receiver when relay 74 is de-energized, and the printer signal circuit is connected to the output terminals of the radio receiver when relay 74 is energized, and in addition the power supply circuit for the printer operating motor is closed.

At the left of Fig. 3 is shown schematically a transmitting station for transmitting signals to operate the receiving system of Fig. 3 already described. Many of the elements are identical with those shown in Fig. 1 and are identified by the same reference characters. The description at the left-hand portion of Fig. 3 will be confined to the differences between the transmitting system shown therein and that shown in Fig. 1.

The tone generator for generating the special signals to control the selection of the facsimile printer is designated 91 and is connected across the terminals of transformer primary 26, with a push button key included at 92, whereby the one hundred cycle tone signal may be transmitted only long enough for relay 74 to become energized and held. The secondary winding 93 of a transformer 94 is connected across the speech input circuit terminals 19 and the primary winding 96 of the transformer has connected across its terminals a tone generator 97 for generating the alternating current at one hundred seventy-five cycles to effect the operation of relay 88 in the receiving circuit. A push button circuit closing key 98 is included in the circuit of primary winding 96 of transformer 94 and tone generator 97 so that the one hundred seventy-five cycle tone may be applied to the input of the radio transmitter for a short interval sufficient in length to effect the operation of relay 88 and thus the release of the slow-to-release relay 74. The band reject filter 99 included in the speech input circuit differs from the filter 18 in Fig. 1 by being arranged to attenuate oscillation of the frequencies generated by both of the tone generators 91 and 97; namely, one hundred cycles and one hundred seventy-five cycles, in order that relays 87 and 88 shall not be operated by oscillations at those frequencies appearing in speech.

In Fig. 4 is shown another embodiment of the invention, having reference particularly to a receiving station. The radio receiver may be the same as that shown in Figs. 1 and 3 and is designated by the reference numeral 101. The speech reproducer 102 is connected to the output terminals of the radio receiver through a band reject filter 103 which attenuates and prevents from reaching the speaker the tone frequency which is employed for the transmission of the facsimile signals and which may be thirty-five hundred cycles per second, as indicated in Fig. 4. Filter 103 will also attenuate and estop from reaching speech reproducer 102 any oscillations at thirty-five hundred cycles per second which may be present in speech signals received by the radio receiver 101, but the intelligibility of such speech will not be thereby materially impaired. The printer signal circuit indicated symbolically at 104 has one of its conductors extending to one of the output terminals of radio receiver 101 through a band pass filter 106 which passes the facsimile signaling frequency. The other conductor of the printer signal circuit also extends through filter 106 and is connected to a contact 107 of manually operable switch 108. The right-hand swinger of switch 108 is connected to the other output terminal of the radio re-

ceiver 101 so that when the swinger is shifted in clockwise direction into engagement with contact 107, the printer signal circuit, including filter 106, is connected across the output terminals of the radio receiver 101. The center swinger of switch 108 and the contact 109, which it engages when the swingers are in extreme counterclockwise position, establish a shunt around the filter 103 so that the filter 103 is prevented from attenuating printer tone signals in the speech reproducing circuit. The extreme left-hand swinger and the contact 111, which it engages when the swingers are in their extreme clockwise position, are included in the power supply circuit for the motor of the facsimile printer.

The operation of the receiving system shown in Fig. 4 is as follows: With the manually operable switch 108 in the position shown, the printer signal circuit is open so that facsimile signals cannot reach the printer and the shunt around one side of the filter 103 is closed so that the filter is rendered ineffective, and the speech reproducer 102 is responsive to speech signals and will also reproduce intermittent tones corresponding to facsimile printer signals, should such signals be transmitted. If there should be no provision for the simultaneous transmission of speech and facsimile printer signals, as is the case in the transmitters shown in Figs. 1 and 3, when the transmission of speech is stopped and the transmission of facsimile signals begins, the facsimile signals will be heard in the speech reproducer 102. This will indicate to an attendant that switch 108 should be shifted to its alternative position which results in the engagement of the right-hand swinger with contact 107, the disengagement of the intermediate swinger from contact 109, and the engagement of the left-hand swinger with contact 111. The operating motor of the facsimile printer will be started and the printer signal circuit will be connected directly to the output terminals of radio receiver 101. Likewise, the shunt around filter 103 will be removed so that the filter will prevent facsimile signals from reaching speech reproducer 102. The speech reproducer circuit remains connected to the radio receiver, however, and is prepared to respond to any speech signals that may be received from the transmitting station while the facsimile message is being recorded. The manner in which speech and facsimile signals may be transmitted simultaneously from a single radio transmitter is shown in Fig. 5 and will be described subsequently. It should be understood with reference to Fig. 4 that the printer signal circuit indicated symbolically at 104 will include the necessary rectifier for converting the successive trains of tone signals to direct current impulses and will also include any amplifier that may be needed to amplify the rectified impulses to sufficient intensity to operate the receiving magnet of the printer.

Fig. 5 shows a complete transmitting and receiving system by means of which speech signals and facsimile signals may be simultaneously transmitted by a single radio transmitter upon one carrier frequency and may be received and channeled to their respective receiver devices which may be operated simultaneously to reproduce the speech message and record the facsimile telegraph message. Referring now to Fig. 5, the reference numeral 121 designates a radio transmitter to the output circuit of which is connected a transmitting antenna 122 and ground 123. The input circuit terminals of the radio transmitter are indicated 124 and to these are connected in parallel microphone 126 and facsimile signaling tone generator 127 in series with which is the normally open facsimile contact indicated 128. Interposed between the facsimile generator and contact, and the input terminals of the radio transmitter, is a band pass filter 129 for passing the facsimile signaling frequency which may have a range of eight hundred to twelve hundred cycles per second and for attenuating all other frequencies. Similarly interposed between the input terminals 124 of the radio transmitter and the microphone 126 is a band reject filter 131 which attenuates frequencies in the range from eight hundred to twelve hundred cycles and passes all other frequencies. With this arrangement, facsimile signals comprising intermittent trains of tone signals between eight hundred and twelve hundred cycles per second may modulate the carrier frequency of radio transmitter 121 and simultaneously speech signals having removed therefrom a band of frequencies corresponding to the facsimile telegraph signaling frequency may modulate the radio frequency carrier.

At the receiving station, there is a radio receiver 132 which has output circuit terminals indicated 133. To the output terminals 133 are connected in parallel the facsimile printer signal circuit 134 including eight hundred to twelve hundred cycle band pass filter 136, and the circuit of speech reproducer 137 including eight hundred to twelve hundred cycle band reject filter 138.

The radio receiver 132 demodulates the received carrier frequencies and delivers to the output terminals 133 a complex wave comprising speech frequencies and intermittent trains of the facsimile signal tones. The filter 136 passes the trains of oscillations representing the facsimile printer signals and these are rectified and amplified in apparatus which, as previously set forth, the printer signal circuit necessarily includes to obtain direct current impulses for operating the printer magnet. Simultaneously received speech signals are rejected by filter 136 but are passed through filter 138 to speech reproducer 137. Filter 138 rejects the facsimile printer signals but passes all of the speech signals. The speech signals do not include frequencies which may pass through the filter 136 because these were attenuated and removed at the filter 131 in the speech input circuit of the transmitter. Thus, it will be apparent that facsimile printer mechanism 134, or speech reproducer 137, may operate individually to respond to signals transmitted from tone generator 127 or microphone 126, respectively, or both of the receiving devices may be operated simultaneously in response to signals transmitted simultaneously from the tone generator 127 under the control of contact 128 and from the microphone 126.

It is to be understood that in the foregoing descriptions of the several embodiments of the invention, the various tone frequencies recited for the facsimile telegraph signaling and for switching control are given by way of example only. The frequencies or combinations of frequencies which may be chosen are many. The principal limitations upon the choice of frequencies are that control frequencies shall differ sufficiently from signaling frequencies, and where more than one control frequency is employed in

a communication system, they shall differ from each other sufficiently that they may be separated by filters and thus channeled to the devices which they are intended to control or operate, and that the frequency bands employed for facsimile signaling or for control signals shall not be so wide as to impair seriously or render unintelligible speech from which corresponding bands of frequencies have been filtered.

Although particular embodiments of the invention have been described in the foregoing specification and illustrated in the accompanying drawings, it is to be understood that the invention is not limited to the particular embodiments shown and described, but is capable of modification and rearrangement without departing from the spirit of the invention and within the scope of the appended claims.

What is claimed is:

1. In a communication system, a signal transmission channel, means for generating speech signals and for applying said signals to said channel, means for generating an oscillatory signaling current at a frequency within the speech frequency range and for applying said oscillatory current to said same channel, means for reproducing speech, signal receiving means responsive to said oscillatory signaling current, means for routing said speech signals and said oscillatory signaling current from said channel to said speech reproducing means and said oscillatory current signal receiving means respectively, and means interposed between said speech signal generating means and said channel for suppressing from the speech signals oscillations at the frequency of said oscillatory signaling current whereby to render the receiving means for said oscillatory signaling current unresponsive to speech signals.

2. In a communication system, a signal transmission channel, means for generating speech signals and for applying said signals to said channel, means for generating an oscillatory signaling current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code and for applying said modulated current to said same channel, means for reproducing speech, means for recording characters according to the modulation of said oscillatory current, means for routing said speech signals and modulated current from said channel to said speech reproducing means and said character recording means respectively, and means interposed between said speech signal generating means and said channel for suppressing, from the speech signals, oscillations at the frequency of said modulated current whereby to render said character recorder unresponsive to speech signals.

3. In a communication system, a signal transmission channel, means for generating speech signals, means for generating telegraph signals, means for generating a control signal, means for alternatively connecting said speech signal generating means or said telegraph signal and said control signal generating means to said channel, means for reproducing speech, means for recording character signals corresponding to said telegraph signals, and means connected to said channel and controlled by said control signal for connecting said speech reproducing means or said character recording means to said channel alternatively.

4. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current within the range of speech frequencies, means for modulating said oscillatory current according to telegraph signals, means for generating another oscillatory current at a frequency within the range of speech frequencies but differing from the frequency of said first mentioned oscillatory current, means for alternatively connecting said speech signal generating means or said telegraph signal generating and modulating means and said other oscillatory current generating means to said same channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, and means responsive to said other oscillatory current for disconnecting said speech reproducing means from said channel and for connecting said character recording means thereto.

5. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating another oscillatory current at a frequency within the speech frequency range but differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said telegraph signal generating and modulating means and said other oscillatory current generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means responsive to said other oscillatory current for disconnecting said speech reproducing means from said channel and for connecting said character recording means thereto, means interposed between said speech signal generating means and said channel for suppressing speech oscillations at the frequency of said other oscillatory current whereby to render said means for disconnecting said speech reproducing means unresponsive to speech signals, and means interposed between said channel and said character recording means for rendering said recording means unresponsive to said other oscillatory current.

6. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating another oscillatory current at a frequency within the speech frequency range but differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said telegraph signal generating and modulating means and said other oscillatory current generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means connected to said channel for rectifying said other oscillatory current, and relay means operable by the output of said rectifying means for disconnecting said speech reproducing means from said channel and for connecting said character recording means to said channel.

7. In a communication system, a signal trans-

mission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating two other oscillatory currents at frequencies within the range of speech frequencies but differing from the frequency of the first mentioned oscillatory current and from each other, means for connecting said speech signal generating means and the first of said other oscillatory current generating means or said telegraph signal generating and modulating means and the second of said other oscillatory current generating means to said channel alternatively, means for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means controlled by the oscillatory current from the first of said other generating means for connecting said speech reproducing means to said channel, and means controlled by the oscillatory current from the second of said other generating means for connecting said character recorder to said channel.

8. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating two other oscillatory currents at frequencies within the range of speech frequencies but differing from the frequency of the first mentioned oscillatory current and from each other, means for connecting said speech signal generating means and the first of said other oscillatory current generating means or said telegraph signal generating and modulating means and the second of said other oscillatory current generating means to said channel alternatively, means for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means for rectifying oscillatory current from the second of said other generating means, means controlled by said rectifying means for connecting said recording means to said channel, means for rectifying the oscillatory current from the first of said other generating means, and means controlled by the second mentioned rectifying means for disconnecting said recording means from said channel and for connecting said speech reproducing means thereto.

9. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory currents according to a telegraph code, means for generating two other oscillatory currents at frequencies within the range of speech frequencies but differing from the frequency of the first mentioned oscillatory current and from each other, means for connecting said speech signal generating means and the first of said other oscillatory current generating means or said telegraph signal generating and modulating means and the second of said other oscillatory current generating means to said channel alternatively, means for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means for rectifying oscillatory current from the second of said other generating means, relay means controlled by said rectifying means for connecting said recording means to said channel, locking means for said relay means, means for rectifying the oscillatory current from the first of said other generating means, and relay means controlled by the second mentioned rectifying means for disabling said locking means.

10. In a communication system, a signal transmission channel, means for generating speech signals connected to said channel, means for generating oscillatory current at a frequency within the speech frequency range and means for modulating said oscillatory current according to a telegraph code also connected to said channel, means interposed between said speech generating means and said channel for suppressing oscillations at the frequency generated by said oscillatory current generating means, means interposed between said oscillatory current generating means and said channel for limiting the frequency of oscillatory current applied to said channel, means for reproducing speech connected to said channel, means for recording characters according to the modulated oscillatory current also connected to said channel, means interposed between said channel and said speech reproducing means for rejecting oscillatory current at the frequency of said modulated current, and means interposed between said channel and said character recording means for rejecting speech signals.

11. In a communication system, a signal transmission channel, means for generating speech signals connected to said channel, means for generating oscillatory current at a frequency within the speech frequency range and means for modulating said oscillatory current according to a telegraph code also connected to said channel, means interposed between said speech generating means and said channel for suppressing oscillations at the frequency generated by said oscillatory current generating means, means interposed between said oscillatory current generating means and said channel for limiting the frequency of oscillatory current applied to said channel, means for reproducing speech connected to said channel, means interposed between said channel and said speech reproducing means for rejecting oscillatory current at the frequency of said modulated current, means for shunting said rejecting means whereby to render said speech reproducing means responsive to said modulated current, means for recording characters corresponding to said modulated current, and means for removing said shunting means whereby to render said rejecting means operative and for connecting said character recording means to said channel.

12. In a communication system, a transmitting station, a remote receiving station, a communication channel connecting said transmitting and receiving stations, a plurality of band pass filters at said receiving station, a corresponding plurality of rectifiers associated with said filters, relays associated with said rectifiers, a plurality of intelligence receivers, and switching means controlled by said relays in response to predetermined frequency bands received over said channel to selectively condition said receivers for message reception.

13. The method of signaling which comprises transmitting a plurality of frequencies simultaneously from one station, receiving said frequencies at a distant station, rectifying one component of said transmitted frequencies at said distant station, and utilizing said rectified component to

establish a switching condition during the reception of said transmitted frequencies.

14. In a transmission system, a transmitting station, a receiving station remote to said transmitting station, a channel interconnecting said transmitting and receiving stations, receiving devices at said receiving station, switching means for selectively connecting said devices to said channel, a relay means responsive to one tone received over said channel to control said switching means to effect a certain relationship between said devices, and another relay means to control said switching means to effect a different relationship between said devices in response to another tone received over said channel.

15. In a communication system, a signal transmission channel, means for generating speech signals, means for generating telegraph signals, means for generating a control signal, means for impressing all of said signals on said channel, means for reproducing speech, means for recording character signals corresponding to said telegraph signals, and means responsive to said control signal to direct said speech signals and said telegraph signals to their respective reproducer and recorder.

16. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current within the range of speech frequencies, means for modulating said oscillatory current according to telegraph signals, means for generating an oscillatory control signal differing from the frequency of said first mentioned oscillatory current, means for alternatively connecting said speech signal generating means or said telegraph signal generating and modulating means and said control signal generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, and means responsive to said control signal for disconnecting said speech reproducing means from said channel and for connecting said character recording means thereto.

17. In a communication system, a signal transmission channel, means for generating speech signals, means for generating telegraph signals, means for generating a control signal, means for alternatively connecting said speech signal generating means or said telegraph signal and said control signal generating means to said channel, means for reproducing speech, means for recording character signals corresponding to said telegraph signals, and means controlled by said control signal for connecting said speech reproducing means or said character recording means to said channel alternatively.

18. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating a control signal differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said telegraph signal generating and modulating means and said control signal generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means responsive to said control signal for disconnecting said speech reproducing means from said channel and for connecting said character recording means thereto, and means interposed between said speech signal generating means and said channel for suppressing speech oscillations at the frequency of said control signal whereby to render said means for disconnecting said speech reproducing means unresponsive to speech signals.

19. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating a control signal differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said telegraph signal generating and modulating means and said control signal generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means responsive to said control signal for disconnecting said speech reproducing means from said channel and for connecting said character recording means thereto, means interposed between said speech signal generating means and said channel for suppressing speech oscillations at the frequency of said control signal whereby to render said means for disconnecting said speech reproducing means unresponsive to speech signals, and means interposed between said channel and said character recording means for rendering said recording means unresponsive to said control signal.

20. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating another oscillatory current differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said means for generating said oscillatory currents and said modulating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means connected to said channel for rectifying said other oscillatory current, and means operable by the output of said rectifying means for disconnecting said speech reproducing means from said channel and for connecting said character recording means to said channel.

21. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating another oscillatory current differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said means for generating said oscillatory currents and said modulating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means connected to said channel for rectifying said other oscillatory current, and relay means

operable by the output of said rectifying means for disconnecting said speech reproducing means from said channel and for connecting said character recording means to said channel.

22. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating another oscillatory current at a frequency within the speech frequency range but differing from the frequency of the first mentioned oscillatory current, means for connecting said speech signal generating means or said telegraph signal generating and modulating means and said other oscillatory current generating means to said channel alternatively, means normally connected to said channel for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means connected to said channel for rectifying said other oscillatory current, and means operable by the output of said rectifying means for disconnecting said speech reproducing means from said channel and for connecting said character recording means to said channel.

23. In a communication system, a signal transmission channel, means for generating speech signals, means for generating an oscillatory current at a frequency within the speech frequency range, means for modulating said oscillatory current according to a telegraph code, means for generating two other oscillatory currents at frequencies differing from the frequency of the first mentioned oscillatory current and from each other, means for connecting said speech signal generating means and the first of said other oscillatory current generating means or said telegraph signal generating and modulating means and the second of said other oscillatory current generating means to said channel alternatively, means for reproducing speech, means for recording characters corresponding to said modulated oscillatory current, means controlled by the oscillatory current from the first of said other generating means for connecting said speech reproducing means to said channel, and means controlled by the oscillatory current from the second of said other generating means for connecting said character recorder to said channel.

24. In a communication system, a transmitting station, speech signal generating means and telegraph signal generating means at said transmitting station, a remote receiving station, a communication channel connecting said stations, speech signal receiving means and telegraph signal receiving means at said receiving station, and switching means operable dependent on the particular type of signals applied to said channel to connect either of said receiving means to said channel to receive signals transmitted thereover.

25. In a signaling system, a plurality of signal generating devices, a communication channel over which signals generated by said signal generating devices are transmitted, and means between one of said signal generating devices and said channel to suppress from the output of said generator signals of the same frequency as those generated by another of said generating devices.

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