

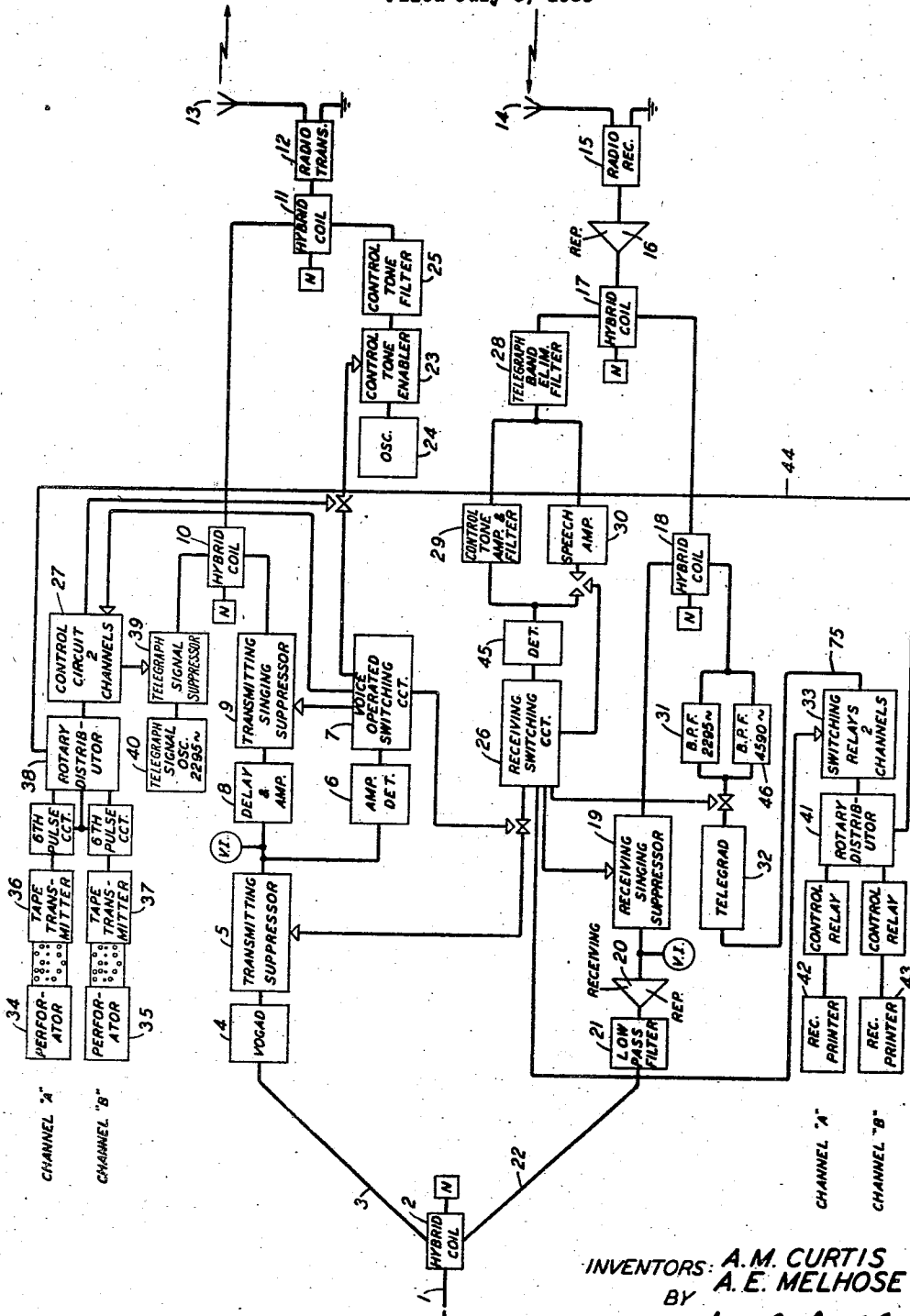
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COMMUNICATION SYSTEM

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COMMUNICATION SYSTEM

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4 Claims. (Cl. 178—66)

This invention relates to communication systems and particularly to electric signaling systems involving a mutable link or a signaling channel capable of or liable to change from internal or external cause which may give rise to interfering energy or, more specifically, subject to noise, fading or change of impedance.

The object of the invention is to insure the correct reception of signals even under exceptional circumstances and severe conditions of disturbance in the mutable link.

It is well known that radio circuits using both side-bands for the same transmission develop interaction between the side-bands when the carrier frequency fades. This interaction causes the fundamental modulating frequency to be converted into a tone of double that frequency and this phenomenon in the past has been a source of annoyance and in some cases where elaborate filtering means have had to be provided, a costly annoyance.

A feature of the present invention is the use of a narrow band-pass filter for admitting to a signal responsive circuit, signals of a given narrow frequency band and in parallel therewith another band-pass filter for admitting to the said signal responsive circuit signals of double the given frequency band. Through such a novel arrangement it has been found that signals which might otherwise be lost are saved, for when deep fading takes place so that the radio carrier frequency drops to such a low level that the fundamental modulating frequency band appears at the receiving apparatus at a level insufficient to perform its duty as a signal, the interaction of the two radio side-bands develops a telegraph signal frequency band of double the fundamental and at a level sufficiently high to act as a signal. Hence, a feature of the invention is to make use of the phenomenon which appears under these conditions in the mutable link and which was heretofore considered an annoyance, to fortify, or act in place of the signal which would otherwise disappear.

The invention is an improvement over the system shown in the Patent 2,207,720, granted July 16, 1940 to Cole et al.

The drawing consists in a single sheet comprising a block diagram giving a general schematic of the system and indicating the novel use of certain well-known instrumentalities.

A speech path 1 leads to a hybrid coil 2 from which a path 3 for outgoing speech leads to a vogad 4. The outgoing speech then passes through a transmitting suppressor 5 and by means of an amplifier-detector 6 operates a chain of relays 7 here labeled as "voice operated switching circuit." This voice operated switching circuit controls a transmitting singing sup-

pressor 9 so that the outgoing speech can pass from the transmitting suppressor 5 through the delay and amplifier 8 and the transmitting singing suppressor 9 to the hybrid coil 10. From the hybrid coil 10 the speech reaches another hybrid coil 11 and thence goes through the radio transmitter 12 to the transmitting antenna 13. Through radio transmission speech will be received at some distant point and for purposes of explanation, it will be assumed that the distant point has a receiving circuit similar in all respects to the lower part of Fig. 1. The speech, therefore, enters antenna 14, passes through a radio receiver 15 and a repeater 16 to a hybrid coil 17. From the hybrid coil 17 the speech goes into hybrid coil 18 thence through the receiving singing suppressor 19, a receiving repeater 20, a low-pass filter 21 and a path 22 to a hybrid coil, such as 2, whence it goes to the receiving subscriber over a line, such as 1.

That part of the circuit between and including the radio transmitter and the radio receiver 15 is spoken of as a mutable link since it comprises a signaling channel capable of or liable to change from internal or external cause which may give rise to interfering energy or more specifically, subject to noise, fading or change of attenuation. It is to be understood, however, that the present showing is by way of example and that the term "mutable link" does not necessarily mean that a space radio link is invariably involved but that the term is broader in its meaning and includes any channel liable to change from internal or external cause.

The voice operated switching circuit 7 controls a control tone enabler 23 so that a source of control tone 24 is passed through the control tone filter 25 to the hybrid coil 11 and thus accompanies speech. The voice operated switching circuit 7 also controls a switching point leading from the receiving switching circuit 26 at the same terminal to the transmitting suppressor 5 so as to open this circuit during the periods when speech is going out from line 1 to antenna 13. During this time the voice operated switching circuit 7 also controls the telegraph control circuit 27 to stop the action of the telegraph transmitting circuit.

At the receiving end the control tone modulating the carrier frequency in the usual manner coming in over antenna 14 is demodulated in radio receiver 15 and passes through hybrid coil 17 and thence through telegraph band elimination filter 28 and into a control tone amplifier and filter 29 and thence into detector 45. This operates the relays of the receiving switching circuit 26 which performs several functions as follows: First, the circuit 26 controls a normally open circuit between the speech amplifier 30 and

the detector 45. This is provided so that when control tone is first received the receiving switching circuit 26 will be operated thereby and then held operated thereafter by speech currents flowing through the amplifier 30. This means that the circuits 29 and 30 are both effective and operative in conjunction with each other to hold the receiving switching circuit chain of relays operated.

The receiving switching circuit 26 also controls the receiving singing suppressor 19 to unblock the speech path upon reception of control tone. The receiving switching circuit 26 also controls a normally closed path between the band-pass filters 31 and 46 and the telegrad 32 so that while speech is being received the telegrad 32 will be disabled. At the same time the receiving switching circuit 26 controls the switching relays 33 for two telegraph channels.

During pauses in speech, either when the subscriber at the distant end is talking into channel 1 or during the time when the subscriber on channel 1 pauses during his talk out over the antenna 13, the telegraph apparatus shown in the upper part of the figure is in operation. This comprises perforators 34 and 35, working, respectively, into tape transmitters 36 and 37 and thence into rotary distributor 38. Rotary distributor 38 works into the control circuit 27 which in turn exercises control over the telegraph signal suppressor 39. A source of telegraph tone is supplied to the telegraph signal oscillator 40 and through the action of the telegraph signal suppressor 39 under control of the control circuit sends telegraph signals into the hybrid coil 10 thence through the hybrid coil 11 and out over the radio transmitter 12.

At the distant end these telegraph signals in the form of spurts of alternating current of the usual form of a carrier oscillator frequency with side-bands about 75 cycles per second wide caused by the modulation of the carrier by the telegraph transmitter are received over antenna 14 and radio receiver 15 and thence pass through the hybrid coils 17 and 18 to the band-pass filters 31 and 46. Thereafter, the signals enter the telegrad 32 and are converted from varying strength alternating current signals to uniform strength direct current signals of practically the same length at which they were received over the antenna 14.

The band-pass filter 31, herein, for example, marked 2295 cycles is a narrow band-pass filter the transmission of which is centered about the same frequency as the telegraph signal oscillator 40. When double side-band transmission is used over the mutable link the interaction of the side-bands under certain fading conditions produces a signal band of double the frequencies of the original frequency band. Thus a narrow band-pass filter 46 has been connected in multiple with the band-pass filter 31 so that when the signals of the 2295 cycles band become so weak through fading that they would otherwise fail to operate the telegrad 32, a substitute signal band centered about 4590 cycles will operate telegrad 32 in its stead.

The operation of the telegrad is fully explained in the application of Barney-Berger-Melrose Serial No. 283,368, filed on even date herewith.

The direct current signals produced by the telegrad 32 pass over path 75 to the switching relays 33 thence through the rotary distributor 41 to the two printers 42 and 43. During the reception

of telegraph signals the receiving switching circuit 26 is unoperated and the speech path is blocked off by the receiving singing suppressor 19.

A line 44 schematically represents the means for keeping the rotary distributor 38 in exact synchronism with the distant rotary distributor 41. The rotary distributor 38 and the rotary distributor 41 at the same terminal may or may not be kept in synchronism. In actual practice they generally are kept in synchronism for reasons having to do with the cost of synchronizing apparatus but from an operating standpoint it is only necessary that the rotary distributors forming part of the same channel be kept synchronized.

The receiving singing suppressor may be of a simple nature, such as the device shown in Patent 1,749,851, granted March 11, 1930 to H. C. Silent or it may be of an improved type fully explained in application Serial No. 283,367, filed by Berger and Curtis on even date herewith.

What is claimed is:

1. In a communication system, a signaling channel including a mutable link, means at the transmitting end of said channel for sending alternating current signals of a predetermined frequency band, means at the receiving end of said channel for receiving and translating alternating current signals, a narrow band-pass filter for admitting to said receiving circuit signals of said predetermined frequency band and in parallel therewith a narrow band-pass filter for admitting to said receiving circuit signals of the second harmonic of said predetermined frequency band.

2. In a communication system, a signaling channel including a mutable link, means at the transmitting end of said channel for sending a carrier frequency modulated by signals of a predetermined frequency band, means at the receiving end of said channel for detecting said signals, a circuit responsive to alternating current signals, a band-pass filter for admitting detected signals of said predetermined frequency band to said signal responsive circuit and in parallel therewith another band-pass filter for admitting detected signals of the second harmonic of said predetermined frequency band to said signal responsive circuit.

3. In a communication system, a signaling channel including a mutable link, means at the transmitting end of said channel for transmitting a predetermined frequency band of alternating current signals by modulated carrier double side-band means, a circuit at the receiving end of said channel responsive to alternating current signals, a narrow band-pass filter for admitting to said circuit signals of said predetermined frequency band and in parallel therewith another narrow band-pass filter for admitting to said circuit signals of the second harmonic of said predetermined frequency band generated in said mutable link.

4. In a communication system, a signaling channel including a mutable link, means at the transmitting end of said channel for sending alternating current signals of a predetermined frequency band, means at the receiving end of said channel for receiving and translating alternating current signals, and filtering means for admitting to said receiving circuit signals of said predetermined frequency band and the second harmonic of said predetermined frequency band.

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