

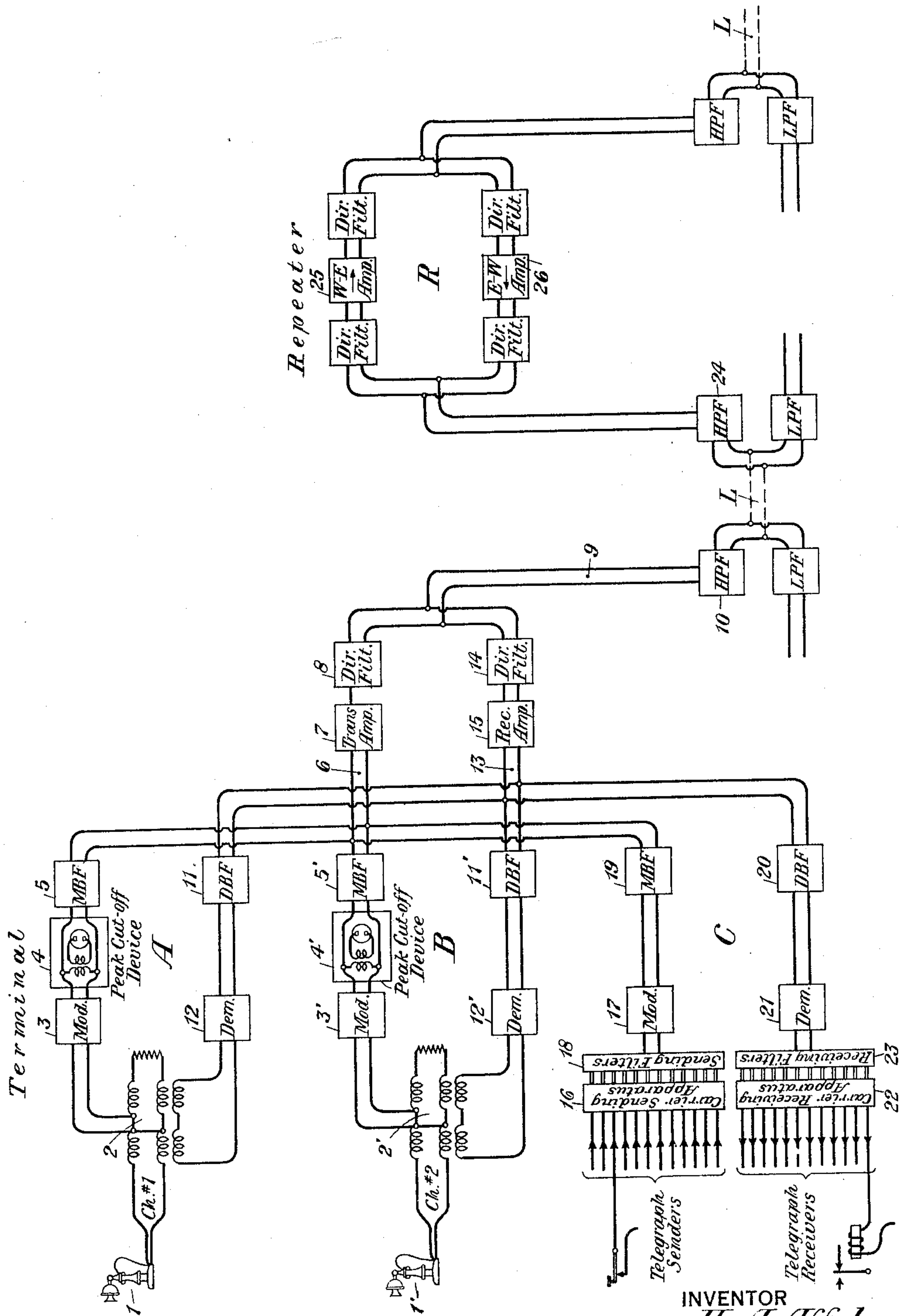
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SUPERIMPOSED CARRIER TELEPHONE AND CARRIER TELEGRAPH SYSTEM

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SUPERIMPOSED CARRIER TELEPHONE AND
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This invention relates to superimposed carrier telephone and carrier telegraph systems, and particularly to a method and means for preventing the carrier telephone currents from causing interference to the carrier telegraph signals whenever the said telephone currents exceed a predetermined value.

In a carrier signaling system in which a plurality of channels are operated over to the same transmission line, it is customary to amplify the currents of all channels by passing them through the same amplifier at each repeater station along the line. No difficulty is experienced with that mode of operation as long as all channels are employed for the same purpose, that is, if all transmit telephone signals, or all telegraph signals.

It is sometimes desirable, however, to employ one or more of the channels of a multi-channel carrier telephone system for telegraph purposes, that is, to transmit over the selected channel a plurality of telegraph modulated waves. Experiments made upon such a combined system have shown that when the combined currents of the telephone and the telegraph waves were amplified by the same repeated the telegraph operation suffered and frequent false signals were produced. That difficulty arose from the fact that whenever the telephonic currents exceeded a predetermined limit, the amplifiers at the repeater stations would be overloaded and the gain of the amplifier would drop. That would cause a corresponding drop in the amplitude of the telegraph currents and would produce the false operation of the relays at the terminals. That situation could be remedied either by lowering the level of the telephone currents passing through the amplifier very substantially, that is, 15 to 20 db., or an amplifier could be provided having much larger tubes than would be necessary for normal operation. The first alternative is undesirable from the standpoint of plant operation, because of the resulting greater interference from external sources, and the latter is uneconomical because of the greater cost of equipment and maintenance.

The object of this invention is to provide a system whereby the occasional excessive telephonic currents or voltages may be eliminated before they reach the common amplifiers at the repeater stations, thus preventing the detrimental effect upon the telegraph channels hereinbefore described.

This invention will be apparent from the following description when read in connection with

the attached drawing showing schematically a simple form of embodiment of the invention.

In the drawing, A, B and C represent three terminal circuits by which signal modulated waves are produced and impressed upon the line L for transmission to a distant station, which distant station would preferably have terminal equipment similar to that shown in the drawing. Connected between sections of the line L is a repeater R of which only the high frequency branch is shown in detail, since it is with that portion that the present invention is concerned. The terminal circuits A and B are arranged to transmit and receive telephone signals, and the terminal circuit C is adapted for sending and receiving telegraph signals. Circuit A comprises a telephone set 1 which is connected with the line windings of the hybrid coil 2. The transmitting branch which is bridged across the line windings, includes a modulator 3, a current limiting device 4, and a band filter 5 intended to transmit the range of frequencies constituting one of the telephone channels. The device 4 includes a gas filled, or vacuum discharge device operable at a predetermined voltage, which is applied by the transformer whose primary winding is bridged across the transmitting path of circuit A. The band filter 5 is connected with the common transmitting branch 6 having therein an amplifier 7 and a filter 8. The output of that filter is connected to the line L by the branch circuit 9 which includes a high pass filter 10. The receiving branch of the terminal circuit A includes a band filter 11, and the demodulator 12, the said band filter being designed to pass the range of frequencies intended for reception by the circuit A. The receiving branch of circuit A is connected with the common receiving branch 13 which includes the filter 14 and the receiving amplifier 15. It will be seen that the modulated waves outgoing from circuit A pass to the branch 6 where they are amplified and impressed upon the branch 9 which in turn impresses those waves upon the line L. The incoming waves from the line L pass to the branch circuit 9 thence to the branch circuit 13, and those waves of the frequency transmittible through the filter 11 will be demodulated by 12 and will pass to the telephone receiver.

The terminal circuit B, in which the parts similar to those of circuit A have been designated by the same numerals primed, has its transmitting branch connected with the common transmitting branch 6, and its receiving branch connected with the common receiving branch 13.

Since circuit B functions in the same way as circuit A, further description is not necessary.

The terminal circuit C also comprises sending and receiving branches. The sending branch, namely the upper one shown in the drawing, comprises carrier sending apparatus 16 (which may be of any well known type) to which a plurality of telegraph sending circuits are connected. The output of the carrier sending apparatus is connected to the input of the modulator 17, the connection including the sending filters 18. The output of the modulator 17 is connected to the branch circuit 6, the connection including the band filter 19. The receiving branch of circuit C which is bridged across the receiving branch 13, includes the band filter 20, and the demodulator 21. The output of the demodulator is connected with the carrier receiving apparatus 22, the connection including the receiving filters 23. The output of the carrier receiving apparatus is connected with the telegraph receiving circuits.

The repeater R is shown as a two-way two element repeater, the upper branch comprising filters and an amplifier for transmitting in one direction, and the lower branch being similarly equipped for transmitting in the opposite direction.

The object of the invention, and the manner in which that object is attained, will be apparent from the following description of the operation of the circuits hereinbefore described. The telephonic currents produced by the transmitter of sub-station 1 of circuit A will be impressed upon the modulator 3, and the modulated wave will be transmitted through the band filter 5 to the transmitting branch 6 wherein it will be amplified by 7 and impressed upon the line L after passing over the branch 9 and through the high pass filter 10. If the transmitter of sub-station 1' is operated at the same time, the wave produced by the modulator 3' will also pass to the common branch circuit 6 and when amplified by 7 will be impressed upon the line L. Likewise, the telegraph signals which are impressed upon the modulator 17 will produce a plurality of waves that will be impressed upon the branch 6, and when amplified by 7 will also be impressed upon the line L. All of those currents will pass through the high pass filter 24 at the repeater R, and will in turn pass through the amplifier in the upper branch of that repeater. If, during the transmission of those signals, the telephonic vibrations produced by one of the sub-stations exceeds a predetermined limit, the modulated current resulting therefrom will likewise exceed its limit, and as a result thereof the amplifier 25 may be overloaded. That would cause the gain of that amplifier to drop, and as a result thereof the telegraph modulated waves passing through that amplifier would also fall off in amplitude, which result would tend to cause the false operation of the relays at the distant terminal of the line L.

That detrimental effect is prevented by means of the current limiting devices 4 and 4' shown connected between the modulators and the band filters in the transmitting branches of the terminal circuits A and B. The particular form of device shown is a two-element vacuum, or

gas filled tube, having characteristics such that ionization takes place at potentials beyond a certain applied voltage, and the impedance of the device, otherwise fairly high, is for those overloaded conditions, lowered to a figure approaching zero. Inasmuch as the potential required to initiate the operation of those devices is ordinarily fairly high, that is of the order of 100 to 200 volts, the device, as illustrated, requires a step-up transformer in order that it will function at the lower voltages normally employed upon modulators used in telephone transmission circuits. It may be noted that the arrangement will also function if the current limiting device is connected in the circuit at the input to the modulator.

It is to be understood however, that the invention is not limited to the particular type of current limiting device shown in the drawing and described herein, inasmuch as other devices may be employed to accomplish the object of this invention, namely, to effectively cut off those peaks of the wave corresponding to vibrations of the telephone transmitter having excessive amplitude.

It will accordingly be seen, with the use of devices for limiting the amplitude of the telephonically modulated waves, the amplifier 25 at the repeater R will not be overloaded, and the detrimental effect heretofore experienced upon the telegraph channel superimposed upon the telephone channels, is substantially eliminated.

While this invention has been disclosed as embodied in a particular form, it is to be understood that such showing is simply to illustrate the invention, which is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a multi-channel carrier telephone system having a carrier telegraph system superimposed thereon, the combination with a transmission line having therein a repeater, of a terminal circuit having means to modulate a carrier wave by telephone vibrations and to impress the modulated wave upon the transmission line, another terminal circuit having means to modulate another carrier wave by telegraph signals and to impress such modulated wave upon said transmission line, the said repeater of the transmission line being arranged to amplify both modulated waves, and means connected with the output circuit of the modulating means of the first mentioned terminal circuit to limit the amplitude of the telephonically modulated waves prior to their impression upon the transmission line.

2. In a system in which carrier telephone and carrier telegraph signals are transmitted over the same path and amplified by the same repeater, the combination with a transmission circuit of a repeater connected therewith, means to apply carrier telegraph signals to said transmission circuit, means to apply carrier telephone signals to said circuit, the latter means including a modulator and means connected with the output circuit of the said modulator to limit the amplitude of the modulated wave to a predetermined level.

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