

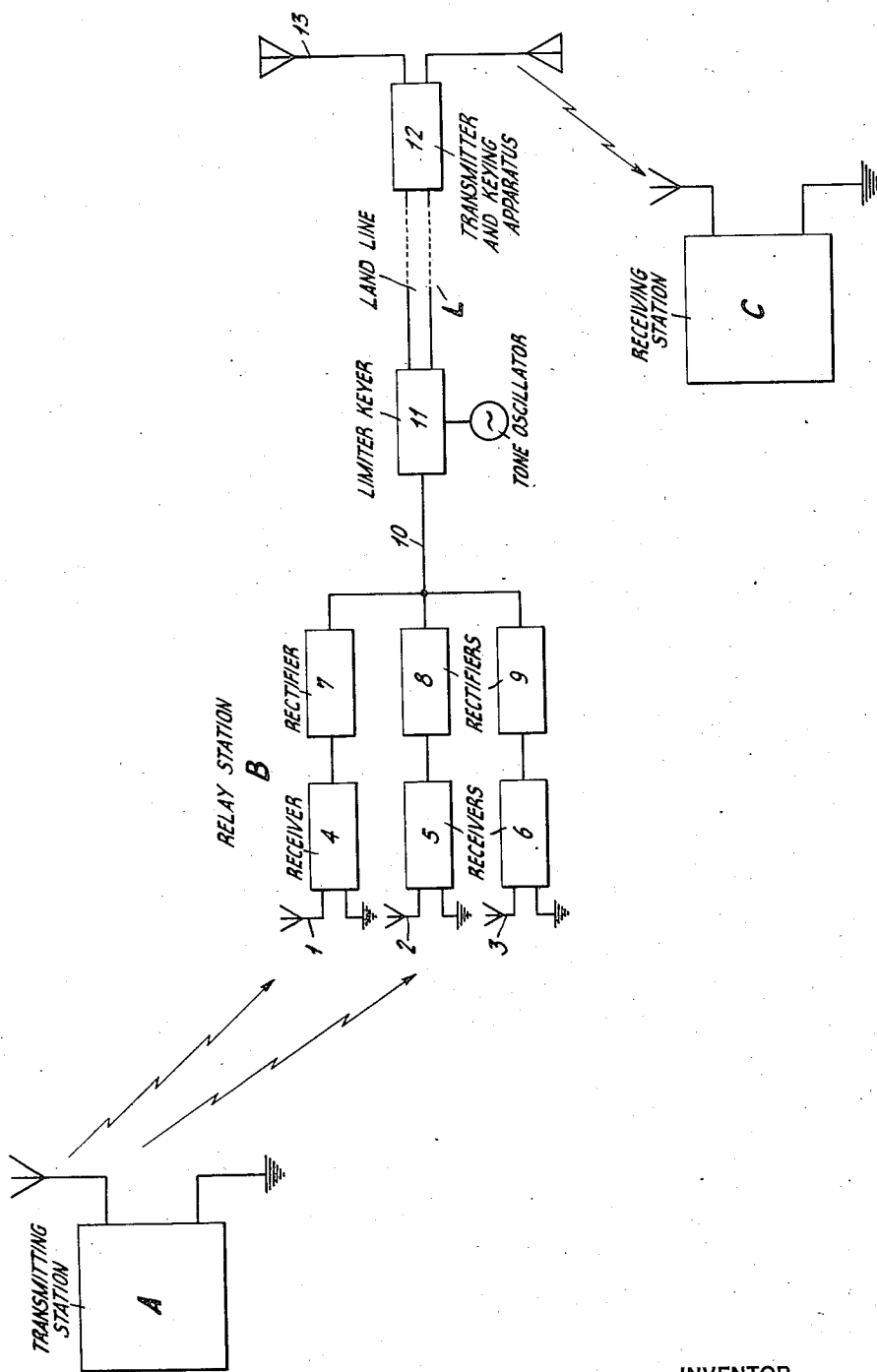
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RADIO TELEGRAPH REPEATER

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RADIO TELEGRAPH REPEATER

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1 Claim. (Cl. 250—15)

This invention relates to radio signal relaying systems of the type wherein there is provided, in addition to the customary transmitting and receiving terminating stations, one or more intermediate repeating stations for relaying signals between widely separated points.

Hitherto, communication over radio relaying systems has not been entirely successful due mainly to interference from static and to variations in the strength of the received signal. A further difficulty in such systems has been experienced in obtaining a suitable power output per channel when it is required to relay several signals simultaneously.

In accordance with the present invention there is provided a system which completely obviates these difficulties and which enables accurate and efficient communication, free from effects due to signal variations or fading.

In general, the invention contemplates the use at the intermediate repeating station, of a diversity receiver in combination with an amplitude limiting device and a tone keying-modulating arrangement. An important characteristic of this repeating station, which is designed to automatically repeat signals without the intervention of operators, is the total absence of mechanical relays and the consequent elimination of inertia due to moving mechanical parts.

Other features and advantages will appear in the following detailed description which is accompanied by a single drawing showing, in conventional form, a circuit diagram of a radio relaying system embodying the principles of the present invention.

Referring to the drawing, there is shown a conventional transmitting station A, in box form, arranged to send message waves to a receiving station C, of any desired type, via an intermediate relaying or repeating station B.

In order to overcome fading and to insure the reception of radio signals at the relay point, station B is provided with a diversity receiving system comprising essentially a plurality of geographically spaced antennae 1, 2 and 3 connected to individual receivers 4, 5 and 6 respectively, the latter, in turn, being connected to individual rectifiers 7, 8 and 9 respectively, in the manner indicated in the drawing. The received signals are combined in a common output circuit 10. Several suitable diversity receivers which may be used at the relaying station B and to which reference is made are described in United States Patents Nos. 1,819,589 and 1,874,866 granted August 18, 1931 and August 30, 1932, respectively, to Messrs. H. H. Beverage and H. O. Peterson.

Since interference and fading effects at the radio frequencies are different at points located an appreciable distance apart from each other, such a diversity receiving arrangement as shown

in the drawing has been found to give a mean amplitude of the combined received signals in circuit 10 which is more constant than the amplitude of the wave received on any one antenna of the group. Observations made on various wave lengths have shown that the receiving antennae 1, 2 and 3 need only be separated from one another by a distance of the order of a few wave lengths or so to overcome the fading effect and to obtain efficient results.

The combined rectified energy in the output circuit 10 is then passed on to a limiter-modulator device 11 which is arranged to translate the rectified direct current pulses into a tone signal for further transmission over a landline L to transmitting and keying apparatus 12, the latter, in turn, controlling radiation of the signals from antenna 13.

Device 11 may be any suitable circuit for changing the rectified energy received by it into a tone signal of a constant amplitude, irrespective of variations over moderate limits of the combined rectifier currents in circuit 10. The individual oscillations of the tone signal may be of any desired frequency—in the present instance preferably an audio frequency since the signal is subsequently utilized for transmission over a landline L. One example of an arrangement for effecting this result is described in considerable detail in the patent to H. H. Beverage, et al., No. 1,874,866, supra, referring particularly to Figure 2 thereof.

The resulting tone signal output sent out by limiting device 11 is chopped up or interrupted at intervals corresponding to the interruptions of the signal characters received by the relay station B and is transmitted over line L to control keying-transmitting apparatus 12 which may be located at any desired distance from the diversity receiver and limiting-modulator device 11.

In order to overcome undesirable characteristics of the line L, which may cause objectionable parasitics in the transmitter 12, the keying apparatus at 12 is made to function substantially independently of the signal character envelope of the controlling tone received over landline L. This may be accomplished by utilizing two values of the rectified tone envelope, one value to suddenly turn on a working or signalling current and the other value to suddenly turn off the current, and in this way prevent intermediate values of the tone, or starting and ending values of the tone, from affecting in any manner the flow of the signalling current and the consequent radiation from antenna 13. Suitable apparatus for effecting this result are known in the art. For example, one method of accomplishing such keying at the transmitter 12, which is herein mentioned only for purposes of illustration, is de-

scribed in U. S. Patent No. 1,887,236, granted November 8, 1932, to J. L. Finch.

The radiations emanating from antenna 13 are, of course, directed toward receiving terminal station C.

There is thus obtained, by means of the present invention, a radio relaying system in which the repeating station is entirely reliable with respect to such matters as suitable power output, freedom from static and fading, and automatic operation without the intervention of operators.

I claim:

The combination with a radio signal relaying station having transmitting and receiving terminating stations, of an intermediate repeating station comprising a diversity receiving system

employing a plurality of geographically spaced antennæ, circuit connections for receiving, rectifying and combining the signals received over said plurality of antennæ, means for translating said combined rectified signals into tone signals of constant amplitude irrespective of variations in said rectified signals, a transmitting antenna system, a line extending between said means and said transmitting antenna system, transmitting and keying apparatus connected to said antenna system for controlling radiation from said system substantially independently of the signal character envelope of the tone signal characters received over said line from said means.

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