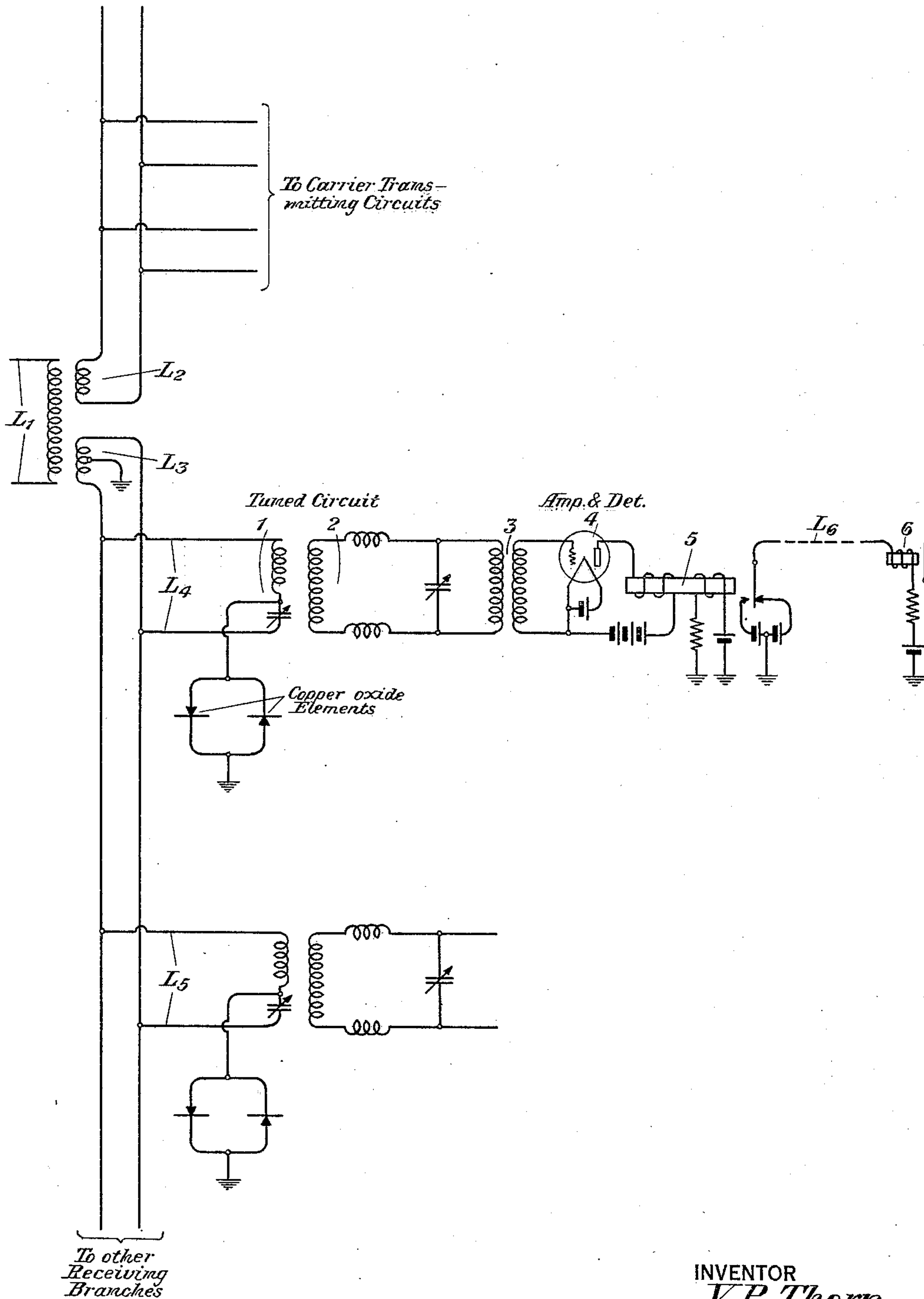


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V. P. THORP
MEANS FOR REDUCING LIGHTNING INTERFERENCE
IN CARRIER TELEGRAPH CIRCUITS
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MEANS FOR REDUCING LIGHTNING INTERFERENCE IN CARRIER TELEGRAPH CIRCUITS

Application filed June 19, 1930. Serial No. 462,382.

This invention relates to means for eliminating the effect of lightning interference upon carrier telegraph signals, and particularly to means to prevent the building up of sustained oscillations by the interaction of the tuned circuits of carrier telegraph systems as the result of such interference.

In the operation of carrier telegraph systems, interference with the reception of signals is frequently produced by voltage surges set up by lightning or other sources extraneous to the transmission lines. While the magnitude of the voltage resulting from lightning may be great relative to that of the signal impulses, such interfering voltages are generally of short duration, in fact, so short that they would not cause the operation of the receiving relay were it not for the presence in the circuits of elements that effectively prolong the duration of such interfering voltages. The elements that effect such prolongation are the tuned circuits of the receiving branches, which, when excited by the interference voltage of great magnitude produce oscillations that are sustained sufficiently long to permit the building up of the operating current of the receiving relay to that value at which the relay will operate.

In my copending application, Serial No. 462,380, filed June 19, 1930, I have disclosed means for reducing the shock excitation of the tuned circuits of the receiving branches of a carrier system by interposing in series with one of the tuned circuits a device whose resistance increases greatly when a negative voltage is applied thereto, thereby tending to dampen the tuning of that circuit by effectively introducing a very high resistance in series therewith.

This invention resides in means for effectively detuning a resonant circuit of a carrier telegraph system whenever the voltage impressed across such resonant circuit exceeds a fixed limit, the said detuning being

effected by the short-circuiting of either of the elements of the tuned circuit.

The invention will be clearly understood from the following description when read in connection with the attached drawing, showing schematically a form of embodiment of the invention.

In the drawing, the line L_1 represents a transmission circuit over which the normal signal voltages of the telegraph channels are transmitted. That line is also exposed to sources of interference that may set up therein abnormal voltages whose magnitude is relatively much greater than that of the signal voltage. The line L_1 is connected with the sending bus L_2 with which are connected the transmitting branch circuits. The line L_1 is also connected with the receiving bus L_3 with which is connected a plurality of branches such as L_4 and L_5 . The winding of the transformer associated with L_3 has its midpoint grounded in order to effect the operation of the detuning apparatus. Connected with the branch L_4 is the series resonant circuit 1 that is coupled with the parallel resonant circuit 2. The junction between the inductance and the capacity of the series resonant circuit is connected to ground through a rectifier that is represented in the drawing as made up of a pair of copper oxide elements connected to ground. Those rectifiers therein shown are intended to pass current in the direction represented by the arrow whenever the voltage exceeds a predetermined limit. The parallel resonant circuit is connected by the transformer 3 with the amplifier-detector 4 that is connected with the receiving relay 5. The latter controls the transmission of the impulses over the loop L_6 to the subscriber's station, represented by the relay 6.

The manner in which the system operates under normal and abnormal voltages will now be described. Assuming the absence of abnormal voltages, the normal signaling

voltages of the frequencies representing the various channels will pass from the line L_1 to the receiving bus L_3 and will be impressed upon the various branches such as L_4 and L_5 .
 5 The resonant circuit 1 will permit the flow of current therethrough of the particular frequency intended to be received by the branch L_4 , which current will produce oscillations in the resonant circuit 2. Those oscillations
 10 will be impressed upon the amplifier-detector 4 and will cause the current flowing through the relay 5 to effect its operation and to transmit an impulse over the loop L_6 to the subscriber.

15 When an interfering voltage wave is impressed by the transmission circuit L_1 upon the receiving bus L_3 , it will in turn be impressed upon each of the receiving branches. Accordingly, a voltage of relatively great
 20 magnitude will be impressed across the series tuned circuit 1 that will effect the operation of one of the copper-oxide rectifiers, for example, the left-hand one, which will establish a circuit from the upper-conductor of
 25 L_4 through the inductance of the tuned circuit 1 through the left-hand rectifier to ground, thence to the midpoint of the winding of the transformer associated with L_3 and thence to the upper conductor of L_4 ,
 30 thereby shunting the condenser of the tuned circuit 1 and preventing the building up of sustained oscillations that would eventually cause the operation of the receiving relay 5. With the reversal in polarity of the received
 35 interference voltage, the right-hand rectifier would be operated which would shunt the inductance of the tuned circuit 1 and in like manner prevent the setting up of oscillations.

40 It is desirable to point out that while copper-oxide rectifiers have been specifically mentioned in describing my invention, the invention is not limited to that rectifier, since other kinds of dry contact rectifiers may be
 45 employed in the working of the invention.

While the invention has been described as embodied in a particular form, it is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.
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What is claimed is:

1. In a carrier telegraph system, the combination with a transmission circuit upon which normal signal voltages and abnormal
 55 interference voltages may be impressed, of a resonant circuit, comprising an inductance in series with a condenser, tuned to signal frequency connected with said transmission circuit, and rectifying means operative at a
 60 predetermined voltage to effectively short-circuit both of the elements of the resonant circuit.

2. In a carrier telegraph system, the combination with a transmission circuit upon
 65 which normal signal voltages and abnormal

interference voltages may be impressed, of a resonant circuit, comprising an inductance in series with a condenser, tuned to signal frequency connected with said transmission circuit, and a copper-oxide rectifier arranged to
 70 effectively short-circuit both of the elements of the resonant circuit whenever the rectifier operates.

In testimony whereof, I have signed my name to this specification this 18th day of
 75 June, 1930.

VAUGHN P. THORP.

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