

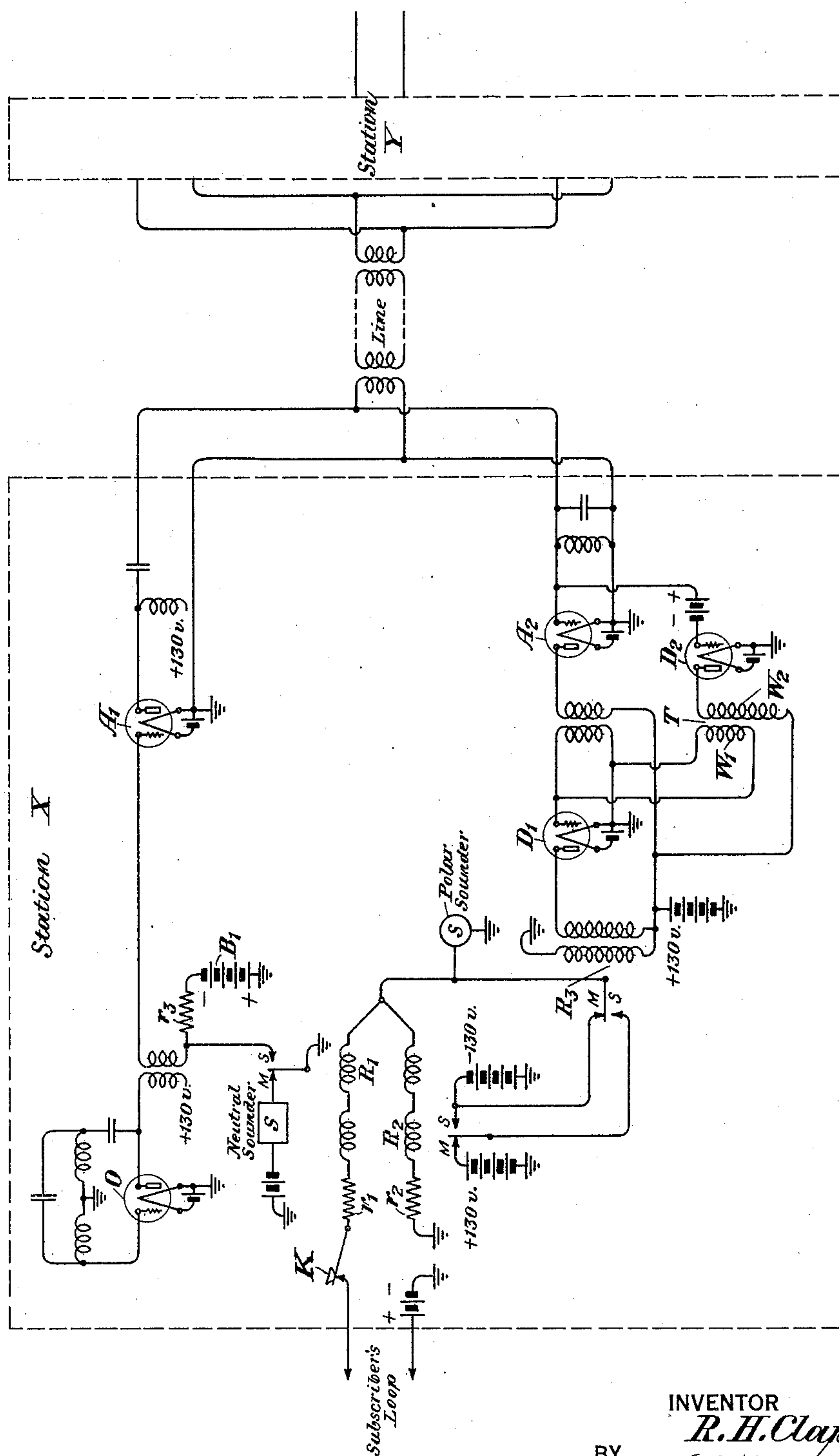
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CARRIER TELEGRAPH CIRCUITS

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CARRIER TELEGRAPH CIRCUITS

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This invention relates to carrier telegraph systems, and more particularly to carrier telegraph systems in which two-way half-duplex operation is provided with the requirement of only one carrier frequency.

The principal object of the invention is to provide for telegraph operation of the type indicated above without the requirement of line balance.

In accomplishing his purpose, the applicant employs the method of operation in accordance with which carrier current is sent into the line to produce a spacing signal and is cut off for a marking signal, and so arranges the apparatus and circuit that the receiving apparatus at either end of the telegraph circuit responds freely to current transmitted from the distant end but is rendered incapable of operation while current is being sent out from the near end.

The invention will be clearly understood when the following detailed description is read with reference to the accompanying drawing, which shows diagrammatically, and in part schematically, one desirable embodiment of the invention.

In the drawing there is shown in such detail as is deemed advisable the apparatus and circuit arrangements of a station X at one end of a carrier telegraph system. The connection from station X to a subscriber's office is indicated at the left of the drawing, and a two-wire line is shown connecting station X to a distant station Y at the right, it being understood that the apparatus and circuits of station Y are identical with those of station X. While the apparatus of a single carrier channel only is shown in the drawing, it is understood that other similar channels may be provided in a multiplex system.

At station X a vacuum tube oscillator O is the source of carrier frequency oscillations and is connected to the input of the vacuum tube amplifier A₁, which transmits the carrier current to the line. The polar relays R₁ and R₂, the resistances r₁ and r₂, the sending key K, the neutral and polar sounders (schematically shown), the receiving relay R₃, and the receiving amplifier A₂ and the rectifier

tube D₁ associated with relay R₃ are all well known in the art.

With the sending key K closed, the armature of relay R₁ is on its marking contact, and a large negative potential is applied to the grid of amplifier tube A₁ by the connection thereto of a battery B₁ through a high resistance r₃; accordingly, the tube A₁ is rendered inoperative and no carrier current is sent out to the line. When the key K is opened, the armature of relay R₁ goes to its spacing contact, the resistance r₃ is grounded through the armature, the tube A₁ is rendered operative, and carrier current is sent over the line to produce a spacing signal at station Y.

Associated with the vacuum tubes A₂ and D₁ in the receiving channel is a second rectifier tube D₂, connected as shown. A transformer T has its low winding W₁ bridged across the input of the rectifier tube D₁ and its high winding W₂ connected in the plate circuit of rectifier tube D₂. There is impressed on the grid of tube D₂ a negative potential great enough to prevent the flow of current in the plate circuit of the tube when signals are received from the distant station Y. Due to this biasing voltage, of course, and the resultant high impedance offered by the transformer T, the bridging of the transformer winding W₁ across the input of tube D₁ causes practically no loss therein, and the signaling from station Y to station X is not interfered with.

When, however, the carrier current from oscillator O is sent out, this current being approximately 20db. higher than the current received over the line from station Y, the negative voltage on the grid of tube D₂ is reduced to the point at which current flows in the plate circuit of that tube. This flow of current through winding W₂ of transformer T reduces to a low value the impedance of the transformer as seen from the input circuit of tube D₁, and the effect of the bridged winding W₁ becomes practically that of a short circuit on the input of tube D₁. Consequently, any current transmitted through amplifier A₂ will not operate the tube D₁, and the receiving relay R₃ is unaffected.

When the sending key K at station X and

the sending key at station Y are both closed, there is no carrier current on the line, and the receiving circuits at both stations are in condition for the reception of signals. If, now, the operator at X, for instance, opens his key K and carrier current from the oscillator O is sent out to produce a spacing signal at Y, the large transmitted current causes in effect a short circuiting of the input of the rectifier D₁ and the receiving relay R₂ is, of course, not operated; at Y, however, the signal is received in the usual way. When the operator at Y wishes to break in, he opens his sending key, and carrier current from the oscillator at Y is sent into the line. As soon as the sender at X closes the key K, the receiving relay R₂ is operated to its spacing contact S, which connects positive battery to that armature. With this condition, no current flows in the sending loop through the resistance R₁ because the ends of that circuit connect to equal potentials. Also, the current is reversed in the windings which are connected through the resistance r₂ to ground, thus holding the relay in marking condition as before. Since no current flows in the subscriber's loop, operation of his key has no effect, and the control of the circuit has passed to the operator at station Y. Thus it is seen that the arrangement disclosed meets the requirements of half-duplex operation.

The receiving amplifier tube A₂ serves to keep the shunting effect resulting from the operation of tube D₂ from interfering with the current transmitted to the line from oscillator O. The sending amplifier tube A₁ serves to stabilize the impedance which terminates the oscillator circuit.

While the invention has been disclosed in one specific embodiment for the purpose of illustration, it is to be understood that it is capable of embodiment in other and different forms within the true scope of the invention as defined in the appended claims.

What is claimed is:

1. In a carrier telegraph circuit, a sending channel and a receiving channel in association with a transmission line, means associated with said sending channel for sending high frequency waves thereover, receiving apparatus in said receiving channel, and a rectifier responsive to high frequency waves originating in said sending channel for disabling said receiving apparatus.

2. In a carrier telegraph circuit, a sending channel and a receiving channel in association with a transmission line, an oscillator associated with said sending channel, a receiving rectifier and a relay controlled thereby in said receiving channel, and an auxiliary three-electrode vacuum tube rectifier associated with said receiving channel and having its plate circuit connected to form in effect a shunt impedance across the input of said receiving rectifier, said auxiliary recti-

fier being biased so that plate current flows therein only when waves which originate in said oscillator flow in the circuit.

3. In a carrier telegraph circuit, a sending channel and a receiving channel in association with a transmission line, an oscillator associated with said sending channel, a sending relay controlling said sending channel to send out or cut off the waves originating in said oscillator, a receiving rectifier and a receiving relay controlled thereby in said receiving channel, and an auxiliary three-electrode vacuum tube rectifier associated with said receiving channel and having its plate circuit bridged across the input of said receiving rectifier through a transformer, said auxiliary rectifier having its grid biased to prevent a flow of plate current in said rectifier except when waves which originate in said oscillator are sent into the circuit.

4. In a carrier telegraph circuit, a sending channel and a receiving channel in association with a line, a source of carrier waves associated with said sending channel, a receiving rectifier and a relay controlled thereby in said receiving channel, and an auxiliary three-electrode vacuum tube rectifier associated with the input of said receiving rectifier in such a manner that when no current flows in the plate circuit of said auxiliary rectifier no appreciable loss is introduced in said input, but when current flows in said plate circuit said input is in effect short-circuited, said auxiliary rectifier being biased so that normally no current flows in its plate circuit, but when a carrier wave is sent into the circuit from said oscillator, current flows in said plate circuit.

5. In a carrier telegraph circuit including a sending channel and a receiving channel in association with a transmission line, a source of carrier waves associated with said sending channel, a rectifier in said receiving channel and a receiving relay controlled thereby, the method of accomplishing two-way transmission on a single carrier frequency which consists in bridging an impedance across the input of the rectifier, adjusting said impedance to introduce normally no appreciable loss in said input, and causing a carrier wave from the source associated with the sending channel to reduce said impedance to introduce a loss in said input sufficient to prevent operation of the rectifier.

In testimony whereof, I have signed my name to this specification this 11th day of March, 1929.

ROBERT H. CLAPP.