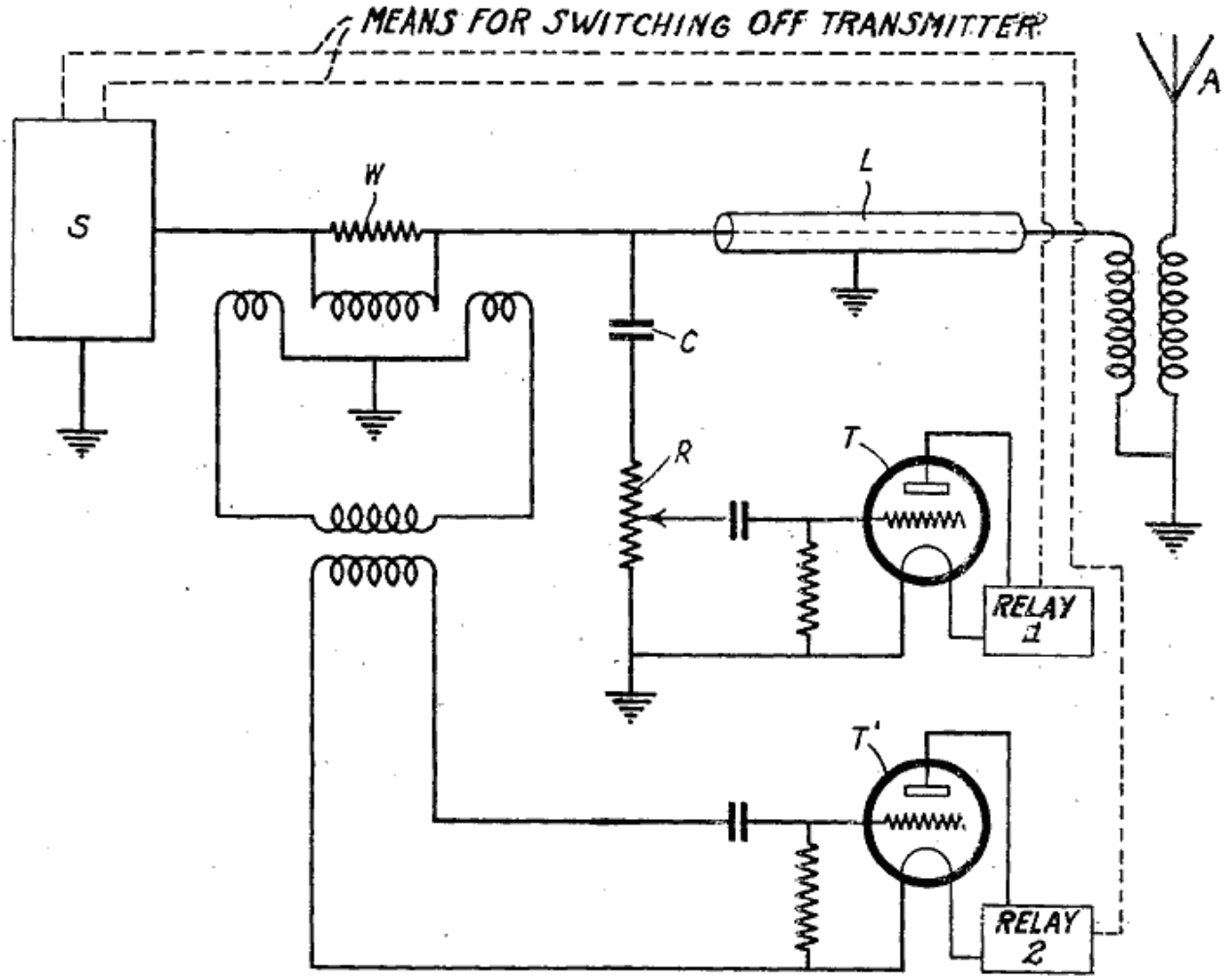
Protection of High Frequency Lines,
Albrecht **Gothe**, Werner **Buschbeck**, and Wolfgang **Kautter**, Telefunken mbH.
US Pat No. **2165848**, July 11, 1939, application Apr 21 1937.

A protection circuit that samples both current and voltage on a transmission line and thereby avoids being fooled by standing-wave nodes.

July 11, 1939. A. GOTHE ET AL 2,165,848

PROTECTION OF HIGH FREQUENCY LINES

Filed April 21, 1937



INVENTORS
ALBRECHT GOTHE
WERNER BUSCHBECK
BY WOLFGANG KAUTTER
ATTORNEY

Patented July 11, 1939 2,165,848

UNITED STATES PATENT OFFICE

2,165,848

PROTECTION OF HIGH FREQUENCY LINES

Albrecht Gothe, Werner Buschbeck, and Wolfgang Kautter, Berlin, Germany, assignors to Telefunken Gesellschaft für Drahtlose Telegraphie, m. b. H., Berlin, Germany, a corporation of Germany

Application April 21, 1937, Serial No. 138,114
In Germany April 1, 1936

7 Claims. (Cl. 250—17)

This invention concerns the guarding of high frequency energy lines against the appearance of stationary waves and of over-voltages of any type.

For the transmission of high frequency energy, for instance in the supply of an antenna from transmitter, power lines are used whose wave resistance is adapted to that of the antenna for the purpose of preventing stationary waves. In all points of the line there exist with correct adaption equal current and equal voltage. If the adaption is disturbed, for instance due to damage to antenna or a line short-circuit, the high frequency waves are reflected at the point of the faulty adaption resulting in the appearance of stationary waves, in other words, current loops and voltage loops, which amount in certain points to a multiple of the currents and voltages existing under adaption conditions and thus endanger the cable. In the case of a faulty adaption, current and voltage will never change in the same direction at a certain point but each of the two values may rise or fall so that it is not sufficient to check on the current or voltage alone at one point for determining a faulty adaption. In accordance with the invention, the current as well as the voltage are checked at any desired point of the energy line and brought to an arrangement which disconnects the energy source with the increase or decrease beyond a limit established as normal of one of the two or both values.

An exemplified embodiment of the idea of the invention will be described in more detail with aid of the drawing. A transmitter S feeds an antenna A over a concentric energy line L. The testing of the adaption is suitably accomplished at the input of line L but may be effected at any other point thereon. For the determination of the size of the current, a small ohmic resistance W is connected in the line wherein the line current produces a potential drop. This potential, proportional to the current, and the potential tapped at a resistance R through a condenser C connected for protection against continuous potential, are brought to rectifiers T wherein are inserted direct-current path relays 1 and 2 which disconnect the transmitter energy source 3 with the appearance of supernormal voltages. As rectifiers there may be used any desired oxide type, diode, grid or anode rectifiers. The grid or audion rectification shown in the drawing offers, however, special advantages in that it works normally with feed current which is reduced with the appearance of high alternating potentials. But this reduction of the direct current occurs also when for some reason or other a fault appears in the protecting arrangement, for instance, non-appearance of the rectifier feed potential or the like. Thus, the protective device insures its own operation against failure to act without supplementary devices.

In grid rectification, the transmitter will also be directly disconnected if the endeavor is made to switch the cable in without the protective arrangement being ready for operation.

The tapping of the potential that is proportional to the line current at resistance W is accomplished as shown by the intermediary of a coupling coil transformer arrangement which is symmetrical to the earth so that the grid of the current control tube is impressed with a potential that is independent of the line potential and proportional only to the line current.

It is further feasible by the suitable selection of the time constants of the rectifier circuits to retard the starting of the protective arrangement in order to prevent the switching off of the transmitter by deviations from the normal state of short duration.

What is claimed is:

1. A protective system for protecting a high frequency energy line comprising a transmitting source, a concentric conductor connected to said transmitting source, means for checking the current and voltage in said concentric conductor including a resistance connected in series with the transmitting source and said concentric conductor, a coupling coil device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to said coupling coil device, the other rectifier being coupled to the concentric conductor by means of a second resistance, the output of each rectifier being connected to a relay circuit, and means responsive to said relay circuits for switching off said transmitting source whereby the transmitting source is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

2. A protective system for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for checking the current and voltage in said concentric conductor including a resistance connected in series with said transmitter and said concentric conductor, a coupling coil

device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to said coupling coil device by means of a transformer, the other rectifier being coupled to the concentric conductor by means of a second resistance, the output of each rectifier being connected to a relay circuit, and means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

3. A protective system for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for checking the current and voltage in said concentric conductor including a resistance connected in series with said transmitter and said concentric conductor, a coupling coil device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to said coupling coil device by means of a transformer, the other rectifier being coupled to the concentric conductor by means of a second resistance and a condenser, the output of each rectifier being connected to a relay circuit, means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

4. A protective system for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for checking the current and voltage in said concentric conductor including a resistance connected in series with said transmitter and said concentric conductor, a coupling coil device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to said coupling coil device arranged symmetrically to ground by means of a transformer, the other rectifier being coupled to the concentric conductor by means of a second resistance and a condenser, the output of each rectifier being connected to a relay circuit, and means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

5. A protective system for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for checking the current and voltage in said concentric conductor including a resistance connected in series with said transmitter and said concentric conductor, a coupling coil device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to a coupling coil device by means of a transformer, the grid of the other rectifier being coupled to the concentric conductor by means of a second resistance having a variable tap, said variable tap being connected in series with said grid, the output of each rectifier being connected to a relay circuit, and means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

6. A protective system for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for checking the current and voltage in said concentric conductor including a resistance connected in series with the transmitting source of energy and said concentric conductor, a coupling coil device coupled to said resistance, two rectifier circuits, each rectifier in said circuits having at least anode, grid and cathode, one of said rectifiers having its grid coupled to said coupling coil device, the other rectifier being coupled to the concentric conductor by means of a second resistance, the output of each rectifier being connected to a relay circuit, said rectifier circuits having retarding means to delay the starting of said protective system and means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

7. A circuit arrangement for protecting a high frequency energy line comprising a transmitter, a concentric conductor connected to said transmitter, means for obtaining a potential drop in said line including a resistance connected in series with the input of said concentric conductor and said transmitter, two rectifier circuits, each rectifier in said circuits having at least an anode, grid and cathode, one of said rectifiers having its grid coupled to said resistance by means of a transformer, the other rectifier being coupled to the concentric conductor by means of a second resistance and a condenser, the output of each rectifier circuit being connected to a relay circuit, and means responsive to said relay circuits for switching off said transmitter whereby the transmitter is switched off when a change of current or voltage values in said concentric conductor beyond a limit established as the normal value occurs.

ALBRECHT GOTHE.
WERNER BUSCHBECK.
WOLFGANG KAUTTER.