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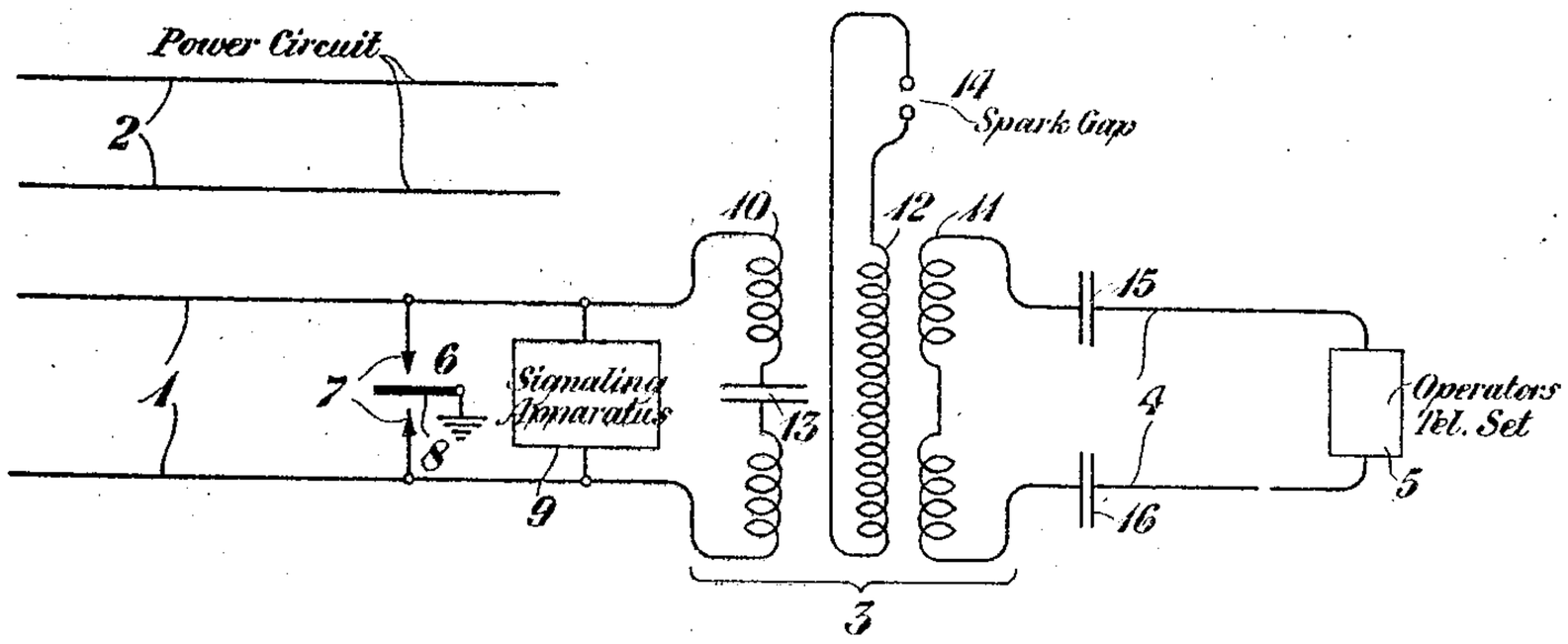
R. K. HONAMAN

VOLTAGE LIMITING DEVICE

Filed April 6, 1922



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UNITED STATES PATENT OFFICE.

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VOLTAGE-LIMITING DEVICE.

Application filed April 6, 1922. Serial No. 550,072.

To all whom it may concern:

Be it known that I, RICHARD K. HONAMAN, residing at Bloomfield, in the county of Essex and State of New Jersey, have invented certain Improvements in Voltage-Limiting Devices, of which the following is a specification.

This invention relates to voltage limiting devices and particularly to a type of multi-winding transformer which is designed to limit the magnitude of the potential that may be applied to a selected section of a circuit.

In the operation of telephone circuits, such for example as long circuits, which are exposed to inductive interference by neighboring power circuits operated at relatively high potentials, trouble known as "acoustic shock" is experienced particularly by the telephone operators when a high potential surge is set up in the exposed circuit, due, for example, to the accidental grounding of the power circuit. The abnormal potential induced in the telephone line circuit produces an abnormal click in the telephone head receiver of the operator. The result of such acoustic shock interferes with the normal operating routine and therefore is detrimental to the service.

It is the object of this invention to provide means for limiting the potential that may be impressed by an exposed line circuit upon the operator's telephone circuit so that the current in the operator's receiver can never exceed a predetermined value regardless of the potential applied across the line circuit, thereby preventing what is known as acoustic shock.

This invention will be better understood from the following description when read in connection with the attached drawing, which shows one form of embodiment of the invention.

In the drawing, 1 represents a telephone line circuit which is exposed to inductive interference from the adjacent power circuit 2. The line circuit 1 is connected by means of the transformer 3 with the switchboard circuit 4, which has connected thereto an operator's telephone set 5. Although the circuit 4 has been referred to as a switchboard circuit it is to be understood that this may be any circuit as, for example, the circuit extending to a subscriber. Since the effect of acoustic shock is usually most severe in the operator's telephone sets, the invention has therefore been described in connection with a switchboard circuit and the operator's telephone set.

Bridged across the sides of the line circuit 1 is a spark gap arrester 6, which may be of any well-known type, having electrodes 7 connected with the sides of the line and a grounded plate 8 inserted between the electrodes but not in contact therewith. 9 represents signaling apparatus of any well known type that may be connected across a line circuit such as 1.

The transformer 3 comprises a plurality of windings, the main windings 10 and 11 being connected with the line circuit 1 and the switchboard circuit 4 respectively. These windings have preferably the same number of turns so as to effect unity ratio of transformation between the line circuit and the switchboard circuit. The line winding 10 has connected in series therewith a condenser 13, in accordance with standard telephone practice for certain types of trunks, but this may be omitted without impairing the scope of this invention. Inductively connected with the windings 10 and 11 is an auxiliary winding 12 having a greater number of turns than the main windings 10 and 11. This winding has in series therewith a spark gap protector 14 which may be adjusted to operate at any given potential. The ratio of transformation of the winding 12 to winding 10 should preferably be quite large. These windings are all arranged upon the same core, which is preferably of a toroidal type such as is used in telephone repeating coils. The switchboard circuit 4 has connected in series with the sides thereof condensers 15 and 16, which is in accordance with standard practice for certain types of trunks.

Having in mind the foregoing description of the circuit in which this invention is embodied it will be better understood from the following description of the mode of operation of the circuit. When a signaling potential such, for example, as that used by voice frequency waves, is impressed across the distant end of the line 1, the current resulting therefrom flowing through the winding 10 of the transformer 3 will induce a potential difference in the winding 11 which will cause current of normal magnitude to flow through the receiver of the operator's

telephone set 5, connected with the switchboard circuit 4. A voltage will also be induced in the winding 12 of the transformer which will be of greater magnitude than that which is induced in the winding 11, since the ratio of transformation is greater between windings 10 and 12 than between windings 10 and 11. This voltage, however, will not be sufficiently great to arc across the air gap of the protector 14, and consequently the circuit of the winding 12 will remain open. It will therefore be seen that under conditions of normal operation the impedance across the winding 12 will be high and the windings 10 and 11 will function in the same manner as in the present type of telephone repeating coil. Under these conditions the transmission characteristics of the coil will be about the same as those of the present standard type of coil.

If, during the course of transmission of voice signals over the line circuit 1, or during any time in which the operator's telephone set is connected with the line 1, the power circuit induces a high potential across the conductors of the line circuit 1, this abnormal potential will ordinarily be applied to the operator's telephone set and produce severe acoustic shock. Since, however, in the applicant's arrangement there is inductively connected to the line winding 10 an auxiliary winding 12, which is adapted to step up the voltage impressed thereon, this abnormal high potential will induce a greater potential in the winding 12, which will cause the air gap of the protector 14 to break down at a predetermined voltage. This, therefore, affords a low impedance path into which most of the energy resulting from the induced high potential will flow, and thereby the switchboard circuit 4 and its associated apparatus is protected. In most instances the amount of energy which would be transferred across the air gap of the protector 14 would be small so that it would be unnecessary to renew the protector except at infrequent intervals.

Although this invention has been disclosed as embodied in a particular circuit arrangement it is to be understood that it is capable of embodiment in other forms and arrangements without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a signaling system, the combination with a line circuit inductively exposed to a power circuit capable of inducing abnormal potentials in the said line circuit, of a switchboard circuit, and a transformer having main windings connected with and adapted to inductively relate said line circuit to said switchboard circuit, and having an auxiliary winding in series with a spark gap adapted to operate at a definite potential in said auxiliary winding.

2. In a signaling system, the combination with a line circuit exposed to inductive interference of a switchboard circuit and a transformer having main windings individual to and connected with said line circuit and said switchboard circuit, and adapted to inductively relate the said circuits, and an auxiliary winding inductively related to said main windings and having a spark gap across the terminals of the said auxiliary winding adapted to operate at a definite potential in the said winding.

3. In an acoustic shock prevention device, the combination of a multiwinding transformer having main windings of substantially equal ratio, and a tertiary winding having a greater number of turns than the said main windings, a line circuit exposed to inductive interference connected with one of said main windings, a telephone circuit connected with the other of said main windings and a spark gap connected in series with said tertiary winding and adapted to become conductive when the potential in the said winding reaches a predetermined value.

4. In a system for protecting against high potentials, the combination with an exposed circuit adapted to have a potential set up therein by an extraneous source, of a circuit to be protected, and a transformer having main windings individual to and connected with the said exposed circuit and the said circuit to be protected and adapted to inductively connect the said circuits, and an auxiliary winding inductively related to the said main windings and having a spark gap across the terminals of the said auxiliary winding to operate at a definite potential in the said winding.

5. In a system for protecting against high potentials, a combination with a multiwinding transformer having a plurality of main windings and a tertiary winding, a line circuit exposed to inductive interference connected with one of said main windings, a circuit to be protected connected with the other of said main windings and a spark gap connected in series with the said tertiary winding and adapted to become conductive when the potential in the said winding reaches a predetermined value.

In testimony whereof, I have signed my name to this specification this 5th day of April 1922.

RICHARD K. HONAMAN.