

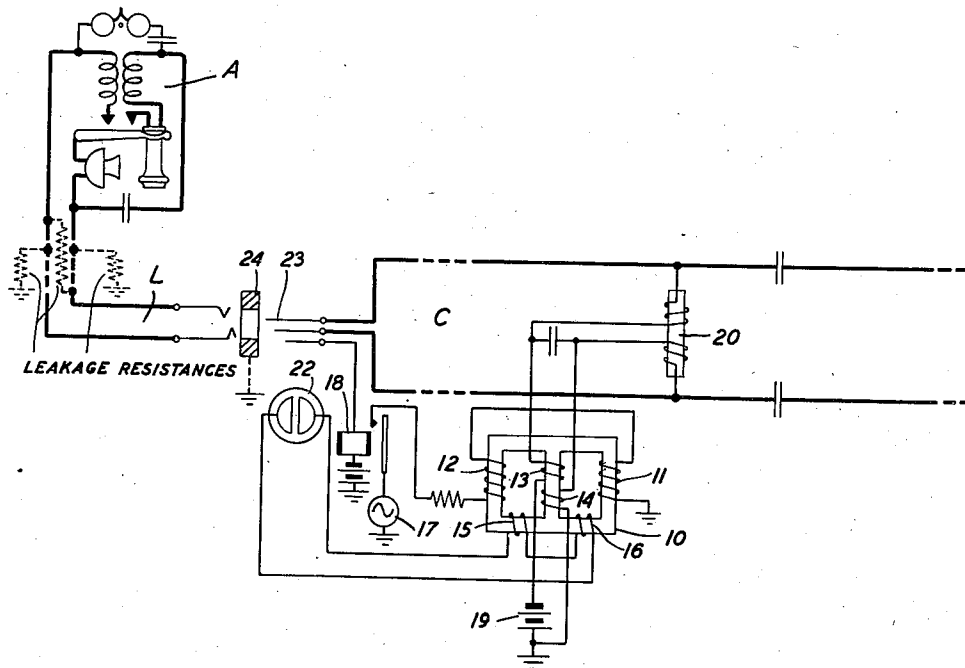
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TELEPHONE SIGNALING SYSTEM

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TELEPHONE SIGNALING SYSTEM

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This invention relates to telephone signaling systems and more particularly to apparatus employed in controlling the operation of supervisory signals commonly associated with telephone link circuits.

It is the object of this invention to increase the range over which telephone supervisory signals may be transmitted.

This object is attained in accordance with a feature of the invention by utilizing, as the supervisory signal control means, a device which is highly sensitive to small changes in the current used to control the operation of the supervisory signals. More specifically, this object is attained by employing a saturable core reactor in place of the electromagnetic supervisory relay commonly used in telephone cord circuits.

The invention will be readily understood from the following detailed description made with reference to the accompanying drawing which shows the invention applied to the calling end of a telephone cord circuit C by which a telephone connection may be extended to a called station A.

In the drawing a saturable core reactor or magnetic amplifier 10 is shown associated with the operator's cord circuit C. The reactor comprises a closed H-type core having an alternating current winding, a control winding and an operating winding. The alternating current winding consists of two coils 11-12 which are wound on the two outer legs of the magnetic circuit and are adapted to be energized from the source 17 when a sleeve relay 18 functions as the consequence of the connection of the cord C to the line circuit L individual to the subscriber's station A. The control winding consists of two coils 13 and 14 wound on the middle leg of the core through which direct current is, for saturation purposes, fed from a battery 19 at the telephone exchange to the tip and ring conductors of the cord by way of the windings of retard coil 20. The operating winding consists of two coils 15 and 16 wound on the yoke pieces which interconnect the middle leg of the core with the two outer legs. A neon lamp 22 is connected across the terminals of the operating winding.

The operation of this circuit depends upon the properties of the saturable core reactor whose impedance can be made to change rapidly for small changes in the direct current used to produce saturation.

The alternating current and direct current circuits are in conjugate relation so that no al-

ternating current voltage is induced in the direct current windings.

The system disclosed operates in the following manner: When the plug 23 of cord circuit C is inserted into jack 24 associated with the subscriber's line circuit L, sleeve relay 18 operates over an obvious sleeve circuit including the sleeve contacts of jack 24 and plug 23. In operating, relay 18 attracts its armature and thereby connects the alternating current source 17 to the input winding comprising coils 11 and 12. A reversing flux is accordingly set up in the magnetic circuit of the reactor. Under this condition an electromotive force of sufficient value is induced in the operating winding to effect the breakdown of the neon lamp 22 which thereupon lights as a supervisory signal.

It is to be understood that the leakage resistance of the line loop shown by the broken lines on the drawing is sufficient to limit the flow of current in the control winding of the reactor to a value small enough to prevent saturation.

The operator now impresses ringing current on the line L in accordance with usual practice. When the subscriber on the line circuit removes the receiver from its switchhook the line loop resistance is diminished, due to the shunting of the leakage resistance across the loop by the resistance of the substation, thereby causing the direct current saturating current to increase beyond the critical value whereupon the magnetic circuit becomes saturated and the operating winding will be of low impedance. The alternating current voltage across the operating winding will accordingly be low and the neon lamp will be extinguished.

When the subscriber hangs up the receiver at the termination of conversation, the loop current drops below the critical value for saturation and a high alternating current voltage appears across the operating winding causing the neon supervisory lamp to again be lighted. The operator would thereupon withdraw plug 23 from jack 24 causing the sleeve circuit including the winding of relay 18 to be opened. Relay 18 accordingly restores its armature causing the disconnection of the alternating current source 17 from the alternating current windings of the reactor. The circuit is accordingly restored to normal.

Due to the fact that the impedance of the reactor changes rapidly with small changes in direct current, the use of such a device in a telephone supervisory signaling circuit results in bet-

ter marginal operation than the supervisory relay circuits in common usage today, thereby increasing the range over which satisfactory supervision is permissible. The electromagnetic relay commonly employed as a supervisory relay does not operate and release on small current changes.

To assume values for illustrative purposes only, the saturating winding 13—14 will be such as to produce saturation of the core on minimum loop current of 10 to 15 milliamperes but will not saturate on maximum leakage current of 6 to 8 milliamperes. The critical value under the assumed conditions is 9 milliamperes. When the subscriber hangs up the receiver at the termination of a call, the loop current drops below the critical value and hence the core of the reactor is no longer saturated (the condition which prevails while the receiver is removed from its switchhook) and a high alternating current voltage appears across the 15—16 or output winding and the supervisory lamp lights.

Obviously, a three-element neon tube of the cold cathode type could be substituted for the lamp 22 and used to perform the operation of releasing the connection in a mechanical switching system if used in place of the manual system illustrated without departing from the spirit and scope of the invention.

What is claimed is:

1. In combination in a telephone signaling system, a line circuit, a link circuit connected with said line circuit, a supervisory signal for said link circuit, and means associated with said link circuit for controlling said signal, said means comprising a saturable core reactor having an operating winding connected across the terminals of said signal.

2. In combination in a telephone signaling system, a subscriber's line circuit, an operator's link circuit connected with said line circuit, a supervisory signal, and means associated with said link circuit for controlling said signal, said means comprising a saturable core reactor whose condition of saturation is varied when the subscriber on said line responds to a connection extended thereto by way of said link circuit.

3. In combination in a telephone system, a line circuit, a link circuit for connection to said line circuit, a supervisory signal for said link circuit, and means individual to said link circuit for controlling said signal, said means comprising a saturable core reactor having an alternating current input circuit which is completed when said link circuit is connected to said line circuit, an output circuit including said supervisory signal, and a direct current saturating circuit connected to the tip and ring conductors of said link circuit.

4. In combination a subscriber's line circuit, a link circuit and a magnetic circuit comprising a core having input and output alternating current circuits and a direct current control circuit, a supervisory signal for said link circuit included in said output circuit, means responsive to the connection of said link circuit to said line circuit for completing said alternating current input circuit and setting up a reversing flux in said core whereupon said signal responds to the voltage induced in said output winding, and means controlled by the subscriber on said line circuit for varying the direct current in said control winding to saturate said reactor whereupon the voltage across said output circuit is reduced and said signal restored to normal.

5. In a telephone system, a subscriber's line

circuit, a link circuit, a saturable core reactor for said link circuit having an alternating current input circuit, an output circuit and a direct current control circuit and whose impedance changes rapidly for small changes in direct current traversing said control circuit to vary the voltage set up in said output circuit upon completion of said input circuit, means effective upon the association of said link circuit with said line circuit for completing said input circuit and connecting said control circuit with said line circuit, means controlled by the subscriber on said line circuit for effecting a variation in the direct current traversing said control circuit, and a signal device included in the output circuit of said reactor.

6. In a telephone system, a line circuit, a link circuit, a saturable core reactor having an alternating current input winding, an output winding and a direct current saturating winding, the voltage set up in said output winding upon completion of said input winding varying inversely with the condition of saturation effected by said saturating winding, means responsive to the association of said link circuit with said line circuit for completing the circuit of said input winding, means controlled by the subscriber on said line circuit for increasing the condition of saturation effected by said saturating winding, and a voltage responsive signal connected across said output winding.

7. In a telephone system, a subscriber's line circuit, an operator's link circuit, a saturable core reactor for said link circuit having an input circuit, an output circuit and a direct current control circuit connected to said link circuit, a supervisory signal included in said output circuit, means responsive to the seizure of said line circuit by said link circuit for supplying alternating current to said input circuit whereupon said signal operates on the voltage set up in said output circuit, and means controlled by the subscriber on said line circuit in answering an incoming call for saturating said saturable core reactor whereupon the voltage set up in said output winding is reduced sufficiently to restore said signal to normal.

8. In a telephone signaling system, a subscriber's line circuit, an operator's cord circuit, a voltage-operated signal associated with said cord circuit, a saturable core reactor having an input winding, an output winding and a control winding, a source of alternating current adapted to be connected to said input winding upon the association of said cord circuit with said line circuit whereupon a voltage of sufficient value is set up in said output winding to effect the operation of said signal, and means controlled by the subscriber on said line circuit in responding to a call extended to said line circuit by way of said cord circuit for altering the impedance of said reactor to lower the voltage set up in said output winding beyond the operating voltage for said signals.

9. In a telephone system, a subscriber's line circuit, a link circuit for extending connections to said line circuit, a saturable core reactor associated with said link circuit having a direct current saturating winding connected to the tip and ring conductors of said link and said line circuit having a normal leakage resistance of such value as to limit the current in said saturating winding to a value insufficient to produce saturation of said reactor, an alternating current input circuit and an output circuit for said reactor, means responsive to the association of said link circuit

with said line circuit for completing said alternating current input circuit whereupon a voltage is set up in said output winding, means controlled by the subscriber on said line circuit in answering a call extended to said line circuit by way of said link circuit for effecting an increase in current in said saturating winding and a consequent decrease in voltage in said output winding, and a voltage responsive signal in said output circuit.

10 10. In combination in a telephone system, a line circuit, a subscriber's station on said line circuit, a link circuit, a neon lamp supervisory

signal for said link circuit which responds to switchhook actuations at said subscriber's station and means controlling said lamp signal in response to said switchhook operations, said means comprising a saturable core reactor having an alternating current input circuit completed when said link circuit is connected to said line circuit, an output circuit including said lamp signal and a direct current control circuit connected to the tip and ring conductors of said link circuit.

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