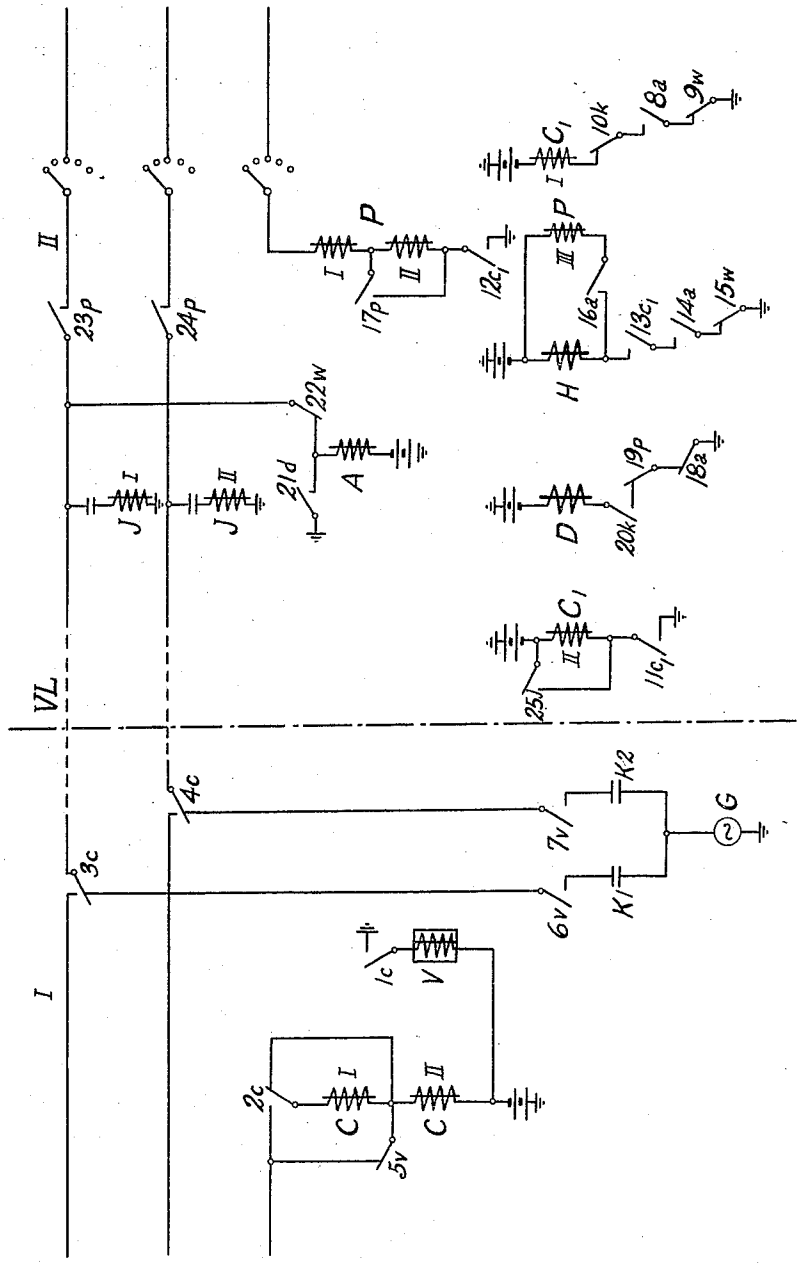
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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The invention relates to a circuit arrangement for telephone systems, especially to an arrangement for controlling switching operations over two-wire junction lines.

In the arrangements of this kind hitherto known different direct current potentials have been applied to the junction lines for the purpose of effecting various switching operations. However, when the telephone area contains several systems, difficulties arise, because the criterion for bringing about a particular switching operation (for example, the release of the connection) may be different for each system. Therefore, it has been proposed to use alternating current for such cases in order to be independent of all direct current potentials. But this may also give rise to trouble, because the switching devices affected by the said alternating current, instead of responding only to this alternating current, would also respond to other alternating currents (for example, ringing currents) used for other purposes and transmitted during the setting up or existence of a connection.

Now, the object of the invention is to avoid these difficulties by providing the junction lines with switching means which effect the initiation of certain switching operations (for example, the release of the connection) when they are influenced by alternating currents of suitable phase displacement (for example 90°) transmitted over the junction line.

It is known that an alternating current relay having several windings works like a direct current relay when the energizing currents in the windings are displaced 90° in phase; that is to say, in this case it keeps its armature attracted so long as it is energized. When, however, alternating currents having a phase difference of 0° or 180° are used, or the relay is energized only by one winding, it chatters. This feature is used by the invention in that for controlling certain switching operations alternating currents of 50 cycles are so transmitted over the two-wire junction lines that the alternating current flowing over one lead of the junction line has its phase displaced about 90° with respect to that flowing over the other lead.

By way of example, the figure shows an arrangement which shows the invention used for releasing a connection.

For the purpose of describing the method of working this arrangement, it will be assumed that the junction line VL has been seized in known manner over a switch in the exchange I. Thereby the relay C was energized and at its contact 1*c* it connected up the relay V, so that the contacts 6*v* and 7*v* were closed, and at the contacts 3*c* and 4*c* switched the junction line through to the exchange II. If impulses now be transmitted, the relay A in the exchange II is repeatedly energized in accordance with the selected number. At the first impulse the contact 8*a* closes a circuit for the relay C1 over: earth, battery, winding I of relay C1, contacts 10*k*, 8*a*, 9*w*, earth. C1 is operated and at its contact 11*c*1 it locks itself over: earth, contact 11*c*1, winding II of relay C1, battery, earth; while at contact 12*c*1 it prepares a circuit for relay P, and at contact 13*c*1 it prepares one for the lifting magnet H. Each time A is energized, the contacts 14*a* and 16*a* close a circuit for the lifting magnet H and for the winding III of the relay P over: earth, contacts 15*w*, 14*a*, 13*c*1, lifting magnet H, and parallel thereto contact 16*a*, winding III of relay P, battery, earth. Relay P keeps itself energized for the entire duration of the impulse train, because its winding II is short circuited over the contact 17*p* and it works as a slow-acting relay. At the end of the impulse train the relay P falls back and at its contact 19*p* it closes the circuit of the rotary magnet D over: earth, contacts 18*a*, 19*p*, off-normal contact 20*k*, which was closed at the first lifting step, rotary magnet D, battery, earth. Upon its energization, D closed the contact 21*d*, thereby operating A over: earth, contact 21*d*, relay A, battery, earth. A at its contact 18*a* opens the circuit of D, which then falls back and at contact 21*d* again interrupts the circuit of A. This causes the contact 18*a* to fall back again. The circuit of D is again closed and the cycle is repeated until the switch has found a free succeeding switch. At that moment P is operated and at contact 19*p* interrupts the circuit of the rotary magnet, thus arresting the

switch. The further setting up of the connection takes place in known manner.

At the end of the conversation when the subscriber connected to the exchange I hangs up his receiver, the relay C is released. The contacts 3*c* and 4*c* fall back at once, while the contacts 6*v* and 7*v* remain closed a moment longer. During this interval the alternating current source G is connected to the junction line VL. By using condensers K1 and K2 of suitable size, the alternating currents flowing from G over the junction line have their phases displaced about 90° from one another, so that now the relay J, which was energized by connecting G to the junction line, pulls up its armature during this interval and at its contact 25*j* it short circuits the relay C1. The latter falls back and at contact 12*c*1 it opens the circuit of P. Hence, 19*p* falls back and again closes the circuit of the rotary magnet. On energizing, D at contact 21*d* energizes relay A again, and the above-described inter-action between D and A causes the switch to be moved on until it returns to its initial position after traversing the level. The further release of the connection takes place in known manner.

Obviously, the invention is not limited to the release of connections, and it can also be used for steering other switching operations over two-wire junction lines.

What is claimed is:

1. In a telephone system wherein an automatic switch is operated to extend a line and is released when alternating current is applied over separate paths to the conductors thereof, a separate condenser in each path of such value that the current in one conductor is out of phase with the current in the other.

2. In an automatic switch, a release relay with two windings, a source of alternating current, a device for connecting said source of current to said relay over two paths, and means for causing the current in one path to be out of phase to that in the other path, said relay arranged to operate effectively only when the current in one winding is out of phase with that in the other winding.

3. In a telephone system, a trunk line extending to an automatic switch, means for operating said switch to extend the trunk line, a double-wound relay connected to the trunk line and responsive to ringing current transmitted thereover to vibrate its armature, a release relay maintained energized to prevent the release of said switch, contacts on said double-wound relay for short circuiting said release relay, the latter relay being non-responsive while the double-wound relay is vibrating its armature under the influence of ringing current, means at the distant end of the trunk line for completing two circuits over the two conductors of said trunk line for the two windings of said double-wound relay, respectively, a source of alternating current included in said circuits, and means for changing the phase relationship between the currents in said circuits in order to cause said double-wound relay to maintain its armature continuously attracted, thereby causing said release relay to deenergize and restore the said switch to normal.

4. In a telephone system, an automatic switch, two conductors, means for operating said switch to complete a talking connection over said conductors, means for applying alternating current to each of said conductors, means for changing the phase relation between the currents in said conductors, and means operated responsive to said currents for releasing said switch.

5. In a telephone system, two exchanges, an interconnecting trunk, a double wound relay connected to the trunk in one exchange, a source of alternating current at the other exchange, means for connecting said source of current to said trunk over separate paths, devices for changing the phase relation between the currents in said paths, said relay operating effectively only when the currents through its windings are out of phase.

6. In a telephone system, two exchanges, an interconnecting trunk, a switch in one exchange, means for operating said switch over said trunk, means at the other exchange for applying alternating current to said trunk for a predetermined period, the current flow over one of the conductors of the trunk out of phase with the current flow over the other conductor of the trunk, and means operated responsive to said current flow for releasing said switch.

In witness whereof, I hereunto subscribe my name this 18th day of February, A. D. 1929.

MAXIMILIAN MATHIAS.