

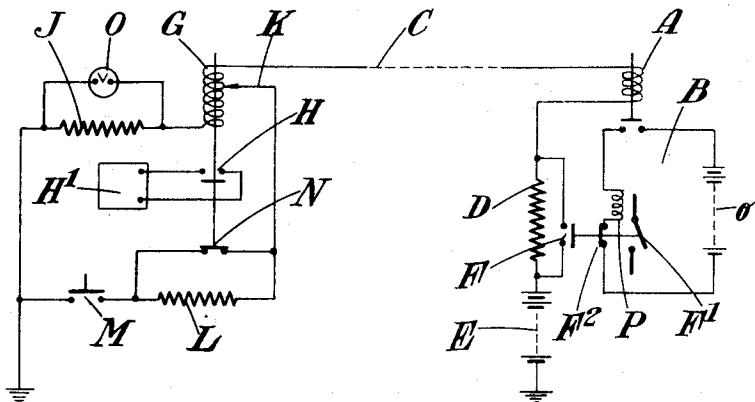
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ELECTRIC SIGNALING OR CONTROL SYSTEM

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ELECTRIC SIGNALING OR CONTROL SYSTEM

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This invention relates to electric signaling or control systems arranged for duplex working, i. e. in which the same circuit (which may consist of a pair of pilot wires or a single pilot wire and an earth return circuit) is utilized for the transmission of currents from both ends either simultaneously or at different times. Although not limited thereto, the invention is more especially applicable to the remote control of an electric power substation, wherein it may be desired for example to transmit from the control station to the substation currents for operating or controlling substation apparatus and also to transmit from the substation to the control station supervisory signals for indicating the condition or operation of substation apparatus.

In the system according to the present invention two relays or other electromagnetic devices are provided, one at each end of the circuit, in series with a source of D. C. or A. C. power, one of the relays having its operating coil or coils divided into two parts, and two contact-making devices, disposed one at each end of the circuit, are so connected to the operating coils of the relays that either relay will respond to the operation of the contact device at the remote end irrespective of the condition of the other relay or contact-making device.

Resistances or reactances are preferably provided which are brought into or cut out from the circuit by the operation of the relays or the contact making devices, the arrangement being such that the current required for the operation of the undivided relay is less than that required for the operation of the divided relay when flowing through one part only of its coil or coils and is greater than that required for the operation of the divided relay when flowing through the other part or the whole of its coil or coils. Conveniently the contact-maker adjacent to the divided relay controls the circuit to the tapping on the coil thereof and acts when closed to short-circuit part of the coil and a resistance in series therewith. An auxiliary contact on the divided relay may act when the relay operates to insert

a resistance in series with this contact-maker. The contact-maker at the other end may act when closed to short-circuit a resistance in series with the two relays.

The accompanying drawing illustrates diagrammatically a preferred arrangement according to the invention intended for the remote control of an electric power substation.

In this arrangement the apparatus at the substation comprises a relay A, which controls a local circuit (indicated at B) for operating substation apparatus, the operating coil of this relay being connected on one side to a pilot wire C and on the other side through a resistance D and a suitable source of power (such as a secondary battery E) to the second pilot wire or to an earth return circuit. The resistance D is shunted by a switch F, whose function is to transmit supervisory indicating signals to the control station. This switch F may be automatically operated by the circuit-breaker F¹ or other substation apparatus whose condition is to be indicated at the control station.

The apparatus at the control station comprises a relay G, which controls at its contacts H an indicating device H¹ the circuit to which is indicated at H and whose coil is connected on one side to the pilot wire C and on the other side through a resistance J (hereinafter referred to as the control station main resistance) to the second pilot wire on earth. The operating coil G is also provided with a tapping K which is connected through an auxiliary resistance L and a control switch M to the second pilot or to earth, this auxiliary resistance L normally being short-circuited by an auxiliary contact N on the relay. The function of the control switch M, which may be hand-operated, is to transmit currents for operating the substation apparatus to be controlled. In the example illustrated the circuit-breaker F¹, whose condition is indicated at the control station, is also taken as the substation apparatus to be controlled by operation of the control switch M. Thus the local circuit B is shown as including a battery o,

a closing coil P for the circuit-breaker F¹ and an auxiliary switch F² on the circuit-breaker.

Thus normally when no signals are being transmitted, the control switch M and the substation switch F are both open, and a circuit is complete through the two relays A and G, the substation resistance D and the control station main resistance J. These resistances are, however, such that the current flowing in this circuit is too small to operate either relay, but this circuit may be utilized, if desired, for measuring the E. M. F. of the source of power E by connecting a measuring instrument O across the control station main resistance J.

If it is desired to transmit a controlling current for operating the substation apparatus (e. g. for closing the circuit-breaker F¹), the control switch M is closed. A circuit is now complete through the substation resistance D, the substation relay A, the small part of the control station relay coil G as far as the tapping K, the auxiliary relay contact N, and the control switch M (the rest of the relay coil and the main resistance J being now short-circuited). The magnitude of the substation resistance is such that the current flowing in this circuit is sufficient to operate the substation relay A (which accordingly causes the desired operation in the substation to be performed), but is insufficient to operate the control station relay G since it is only flowing through a small part of the coil thereof.

If now the substation switch F closes (which may for example as shown take place as the result of the operation of the substation apparatus), it will act to short-circuit the substation resistance D, thus increasing the current sufficiently to operate the control station relay G, although this current is only flowing through part of the relay coil. The operation of this relay G, besides causing the desired indication to be given, opens the auxiliary contact N, as a result of which the auxiliary resistance L is inserted across the rest of the relay coil G and the main resistance J. This decreases the current flowing, but leaves it still sufficient to hold both relays in their operative positions.

If at this stage the substation switch F opens again, it will reinsert the substation resistance D, so as to reduce the current sufficiently to deenergize the control station relay G but to leave the substation relay A still energized. If on the other hand the substation switch F remains closed and the control switch M is opened, the whole of the control station relay coil will be left in circuit with the substation relay coil and the control station main resistance J, but the magnitude of this resistance is such that the substation relay A will be deenergized leav-

ing the control station relay G still energized. It will be noticed that this circuit is exactly that which would be completed by the closing of the substation switch F from the original normal position shown on the drawing.

Thus it will be clear that, whatever the condition of the substation switch F and the control station relay G, the substation relay A will respond to the closing of the control switch M and will be deenergized when the control switch M is opened. Similarly, whatever the condition of the control switch M and the substation relay A, the closing or opening of the substation switch F will cause the energization or deenergization of the control station relay G.

It will be appreciated that the invention may be carried out in other ways than that more particularly described and may be employed for purposes other than the remote control of substations, such for example as for duplex telegraphy.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In an electric signaling or control system arranged for duplex working, the combination with the circuit over which the signaling or control currents are passed, of two electromagnetic devices disposed one at each end of the circuit, one of the devices having its operating coil divided into two parts such that the current required to operate the undivided-coil device is less than that required to operate the divided-coil device when flowing through one part only of the divided coil and is greater than that required to operate the divided-coil device when flowing through the whole of its coil, a source of power connected in series with the operating coils of the two electromagnetic devices, two contact-making devices disposed one at each end of the circuit, and means whereby either electro-magnetic device will respond to the operation of the contact-making device at the remote end irrespective of the condition of the other electro-magnetic device and of the other contact-making device.

2. In an electric signaling or control system arranged for duplex working, the combination with the circuit over which the signaling or control currents are passed, of a relay and a contact making device at each end of said circuit, a tapping connection which divides the operating coil of one of the relays into two parts such that the current required to operate the undivided-coil relay is less than that required to operate the divided-coil relay when flowing through one part only of the divided coil and is greater than that required to operate the divided-coil relay when flowing through the whole of its coil, a source of power connected in series with the operating coils of

the two relays, means whereby on operation of the contact-making device associated with the undivided relay a current flows in the circuit of such value as to operate the divided relay and leave the undivided relay unaffected, and means whereby operation of the contact-making device associated with the divided relay controls a circuit associated with the tapping connection and causes the magnitude of the current flowing through the relay coils to be varied.

3. In an electric signaling or control system arranged for duplex working, the combination with the circuit over which the signaling or control currents are passed, of two electro-magnetic devices disposed one at each end of the circuit, one of the devices having its operating coil divided into two parts such that the current required to operate the undivided-coil device is less than that required to operate the divided-coil device when flowing through one part only of the divided coil and is greater than that required to operate the divided-coil device when flowing through the whole of its coil, a source of power connected in series with the operating coils of the two electro-magnetic devices, two contact-making devices disposed one at each end of the circuit, and resistances which are selectively brought into or cut out from the circuit by the operation of the contact-making devices and are so dimensioned that either electro-magnetic device will respond to the operation of the contact-making device at the remote end irrespective of the condition of the other electro-magnetic device and of the other contact-making device.

4. In an electric signaling or control system arranged for duplex working, the combination with the circuit over which the signaling or control currents are passed, of a relay and a contact-making device at each end of the circuit, a tapping connection which divides the operating coil of one of the relays into two parts such that the current required to operate the undivided-coil relay is less than that required to operate the divided coil relay when flowing through one part only of its coil and is greater than that required to operate the divided coil relay when flowing through the whole of its coil, a source of power connected in series with the operating coils of the two relays, a resistance in series with the divided coil relay coil, means whereby the operation of the contact-making device adjacent to the divided coil relay brings the tapping connection into circuit and cuts out from circuit part of the relay coil and the series resistance, and means whereby the operation of the contact-making device adjacent to the undivided-coil relay causes the magnitude of the current flowing through the relay coils to be varied, the magnitudes of the re-

sistances being such that either relay will respond to the operation of the contact-making device at the remote end irrespective of the condition of the other relay and the other contact-making device.

5. In an electric signaling or control system arranged for duplex working, the combination with the circuit over which the signaling or control currents are passed, of a relay and a contact-making device at each end of the circuit, a tapping connection which divides the operating coil of one of the relays into two parts such that the current required to operate the undivided-coil relay is less than that required to operate the divided-coil relay when flowing through one part only of its coil and is greater than that required to operate the divided-coil relay when flowing through the whole of its coil, a source of power connected in series with the operating coils of the two relays, a resistance which is normally connected in series with the undivided-coil relay coil but is short-circuited by the operation of the contact-making device adjacent to the undivided-coil relay, a resistance which is normally connected in series with the divided-coil relay coil but is short-circuited together with part of such coil by the operation of the contact-making device adjacent to the divided-coil relay, means whereby the operation of the contact-making device adjacent to the divided-coil relay causes the tapping connection to be brought into circuit, and a resistance which is inserted when the divided-coil relay operates in series with the adjacent contact-making device, the magnitudes of the resistances being such that either relay will respond to the operation of the contact-making device at the remote end irrespective of the condition of the other relay and the other contact-making device.

In testimony whereof I have signed my name to this specification.

RALPH WILLOUGHBY.