REMOVEDLY CONTROLLED POWER SYSTEM

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The invention relates to remotely controlled power systems and more particularly to the selective cutting in and out of various power consuming devices at one or more receiving stations by suitable signalling impulses sent from a transmitting station.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to hereinafter in and constituting a part hereof, illustrates one embodiment of the invention, and together with the description, serves to explain the principles of the invention.

The single figure of the drawing is a schematic wiring diagram showing an illustrative embodiment of the invention.

The remote control of power consuming devices has generally been accomplished by one of several methods. Thus, in one method, the power transmitting line or lines itself are used. In such a system the signalling impulses may be transmitted by interrupting the current circuits in the main line. Such a system, however, is inherently expensive for the reason that such large amounts of power are being interrupted that heavy and expensive switch gear is required. In addition thereto is the inconvenience if not the danger of interrupting the flow of power in the transmitting lines.

Another method of utilizing the transmitting line, lies in the superposition of alternating currents at different frequencies. This, however, is rather complicated since filter circuits and tuned relays are required all of which must be suitably insulated from any high potentials which may be present on the transmitting line.

It is also possible to provide a separate control circuit over which signalling impulses may be sent. Such a separate control system, however, is rather expensive to maintain since it represents considerable wire.

The invention hereinafter described discloses a means for controlling remotely controlled apparatus such as integrating meters, hot water heating systems, signalling instruments and switching means for streets, passageways, display windows and house wiring through a separate control line. However, a greater flexibility and range of operation of the system is obtained by the use of simple switching relays controlled directly by the switching on and off of the control line for operating on devices such as recording meters and the like.

If the system has a separate control line with switching relays for controlling the operation of meters, then it is only necessary to add suitable signal transmitting means.

The drawing shows a transmitting line with a transmitting station and two receiving stations for controlling the latter.

The transmission line is of the alternating current three-phase type wherein three main lines R, S and T are provided with a neutral return conductor O and a control conductor ST. A transmitting station A and two receiving stations B and B' are shown connected to the various lines.

Transmitting station A is provided with a rotary switch I having a movable contact 2 and stationary contacts 3 to 12 inclusive. It is understood, of course, that the number of stationary contacts is merely exemplary and may be increased or decreased as desired. Rotary switch I is controlled by a synchronous motor 13 driving the rotary contact 2. In practice rotary switch I is driven by synchronous motor 13 through a step-down system of gearing.

Synchronous motor 13 is provided with suitable means here shown as a simple rotary switch 14 whose purpose is to insure that at each operating cycle, the motor will drive the rotary switch through to a predetermined zero setting position and then stop in preparation for a new operating cycle. Switch 14 has a contact 14a directly coupled to contact 2 to rotate therewith. A contact 14b is provided for maintaining the motor circuit during the operating cycle. It might be stated that synchronous motor 13 and rotary switch I are essentially duplicated in the receiving stations, the object being to provide a synchronously driven rotary switch whose speed and position at the various stations will correspond. These rotary switches, of which I is an example, are not continuously driven but go through an operating cycle where the rotary switch is driven through a complete revolution at a comparatively slow speed and then stops. Since such synchronous zero stops intermittently operated systems are well known, a detailed description thereof is deemed to be unnecessary.

A starting switch 15 is adapted to control the application of current from line T to rotary com-
tact 2. A pair of selector switches 16 and 17 are connected between switch points 4 and 5 respectively and the winding 18 of a quick acting relay 19. Winding 18 has its end connected to neutral conductor O. The armature of relay 18 is connected to control terminal 22 of the winding 22 of an autotransformer. The winding of terminal 22 is connected to neutral conductor O and the other terminal is connected to line T. Contact 18c is connected by suitable wire to 22c on winding 22.

The receiving station B is provided with a double tariff integrating meter z, a contact selecting arrangement k, a hot water storage tank heating system w, and a current consuming device a of whatever nature desired.

The double tariff meter z consists essentially of a meter system 23 having the usual current and potential windings as shown and a tariff controlling relay 24 whose armature 29 is normally biased upwardly by a spring 25. Thus the normal upper bias of armature 29 serves to connect integrating mechanism 27 to the meter proper. A different class of integrating mechanism 28 may be engaged upon the movement downwardly of armature 28 of the relay winding 24.

Referring to the contact selector k this corresponds generally with the contact selector of the transmitting station A, corresponding elements being indicated by correspondingly prefixed reference numerals. In place of switch 15 of transmitting station A, however, a quick acting receiving relay 29 whose armature operates with a contact 30 is provided. This relay is adjusted to operate at a potential substantially higher than that to which relay 24 responds. The winding of relay 29 is connected across lines O and ST while the relay contact 39 and armature therefor are connected between rotary contact 2' and line T. In addition a contact arrangement is provided with a relay 31 of the tilting armature type having windings 21 and 22 connected between switch points 4' and 5' and line O. Relay 31 operates upon an armature cooperating with switch contact 34, it being understood that the armature remains either in the closed or open position after energization of the windings of the relay.

Station B' is provided with a meter z' and a contactor arrangement k' controlling a load a'.

The system operates in the following manner: Assume that switch 21 is closed by clock 20 at a predetermined time. A circuit is thus established from line O through a portion of winding 22 of point 22', contact point 19b, armature 19 to control line ST. Thus a certain definite potential is applied to the control line ST and in response thereto winding 24 of the relay in meter z is actuated to pull down and retain armature 29 so that the upper integrating train 22 is used, as long as time switch 21 is closed. When time switch 21 is open it is understood that the meter z reverts to the condition shown in the drawing. The same thing applies to the meter z' in station B'.

If, for example, the hot water storage tank w is to be switched on from the transmitting station A, the key contact 15 and selector switch 16 of the transmitting station A are closed. This switching may be effected either by hand or by suitable power or automatic means. It is necessary that the selector switch 16 be held in a closed position until the completion of the selecting switch operation.

The closing of switch 15 completes two circuits from line ST through switch 15, rotary contact 2, contact point 8 and then through a suitable connection to relay winding 18 to the neutral conductor O. The other circuit goes from T through switch 15 through synchronous motor 13 and finally to line T. The winding of the first completed circuit, relay 19 is quickly operated to pull armature 19 and close contact 19a. This particular circuit is closed for a short time, due to the operation of the synchronous motor 13 and movement of arm 2 and serves to apply for a short interval of time a voltage on control line ST which is normally higher than that due to the contact position 19b. The relay 20 of the receiving station B is adapted to respond to this higher voltage and momentarily closes the circuit of contact 30.

The closing of relay 19 and relay 20 are quick-acting since at the same time that these relays operate, synchronous motor 13 at station A begins to operate. This is due to the closure of the circuit therefor. The operation of high speed relay 29 in station B closing contact 30 also serves to start the synchronous motor of this station. By virtue of the gearing down of the rotary contacts at both stations with reference to the driving motors, the slight difference in time of the starting of the synchronous motor at station A as compared to the starting of the motor at station B has substantially no effect. Coincident with the starting of the motor, the zero set switches 14 and 14' are both closed by the motor and kept closed until the entire switching cycle of the rotary switch is completed. By virtue of the closure of these switches 14 and 14', the synchronous motor circuits are retained in a closed condition in spite of the fact that the rotary contacts 2 and 2' are moved from zero setting switch points 8 and 8'.

Since the two rotary contacts 2 and 2' of the selectors run synchronously and the selector switch 16 of the transmitting station A also remains closed for the selector cycle after it has been actuated, as soon as the two rotary contacts 2 and 2' arrive at the switch points 4 and 4', the quick-acting transmitting relay 19 at the sending station A is again energized. The circuit goes from switch point 4 through switch 16 which remains closed during the operation of the synchronous motor and relay winding 18. Again armature 19 is pulled over to contact point 19a so that a greater than normal potential is applied to control line ST. This again affects the quick-acting relay 29 at station B so that contact 30 is closed. At this time switch point 4' of the under rotor contact 2' with the result that winding 32 of relay 31 is energized. In this position the armature of relay 31 may be pulled down to engage its switch contact 34 to complete a power circuit to hot water tank heating system w.

As soon as the rotary switch reaches zero position shown in the drawing and the selector switch 16 has again opened up, the entire system assumes the position shown in the drawing with the exception that the armature of relay 31 remains in the closed circuit position engaging contact 34 to support the hot water system with current. The entire system is thus in a position to transmit new signals.
If it is desired to open up the hot water heating system \( w \) as shown in the drawing, the switching cycle previously described must be repeated. This time switch \( 11 \) must be operated. Hence, the high voltage impulse to the control line \( ST \) will be given when switch points \( 5 \) and \( 5' \) are reached. It must be remembered that rotary switch \( 1 \) and \( 1' \) are relatively slow acting so that relay \( 18 \) may snap to the closed position at the proper time. When switch point \( 5' \) is reached at station \( B \), winding \( 33 \) of relay \( 31 \) will be energized and this will serve to move the relay armature from contact \( 34 \) to open the power circuit.

It is understood that during the short interval of time that control \( ST \) has impressed thereon a higher than normal potential due to the action of relay \( 18 \), that relay \( 24 \) in the meter \( z \) may be momentarily energized if the time switch \( 21 \) happens to be open. Since the time of energization is short it has no appreciable effect.

In the event that it is desired to either open or close the circuit for energizing consuming device \( a \) in station \( B \), a substantially similar procedure as described in connection with device \( w \) may be employed. In this case, however, switch points \( 6 \) and \( 7 \) of transmitting station \( A \) and the corresponding switch points \( 6' \) and \( 7' \) of transmitting station \( B \) must be used. Suitable switches corresponding to \( 16 \) and \( 17 \) of transmitting station \( A \) and the relay corresponding to \( 31 \) with the on and off winding must be connected to the corresponding switch point.

It is understood, of course, that at station \( B' \) various devices may be controlled and the contactor \( k' \) may be utilized in the manner similar to contactor \( k \) at station \( B \). It is not necessary that the corresponding switch point of station \( B \) be utilized at station \( B' \). In fact, at station \( A \), switch points \( 9 \) to \( 12 \) inclusive, for example, may be used to control apparatus at station \( B' \). It is thus possible to arrange for either the simultaneous or selective operation of several different receiving stations.

It is understood, of course, that instead of the auto-transformer \( 22 \) a source of direct current having different potentials may be used.

It will be noted that the effects of time switch \( 21 \) on meters \( z \) and \( z' \) are independent of the condition of the selector circuit, except for momentary higher potentials on meter relay \( 24 \), and vice versa. Thus, the meter or any similar piece of apparatus is actuated by a more or less steady circuit condition while the other devices such as \( w \) and \( a \) are controlled by selector impulses.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claim without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

An electric power transmission system, including a control station and a receiving station having a power transferring device and power consuming apparatus adapted to be connected with electric power through said transferring device, a control system current supply means operable to provide a low operating control voltage and a high operating control voltage, a remote control system for said transferring device operable by the lower control voltage comprising controlled transmitting means at the control station for controlling the transmission of the lower control voltage and receiving means at the receiving station for controlling the transferring device by the lower voltage in accordance with the operation of the transmitting means at the control station, and a selective remote control system comprising transmitting means operable at the control station for transmitting the higher control voltage of said control system current supply means for controlling receiving means at the receiving station operable by the higher control voltage only for selectively connecting power consuming apparatus at the receiving station with the electric power through said power transferring device.

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