

Oct. 28, 1969

SHUNSEI KRATOMI
AND-CIRCUIT-CONTROLLED PROGRAM SWITCH
HAVING MATRIX OF CORD CONNECTORS

3,475,747

Original Filed March 3, 1963

10 Sheets-Sheet 1

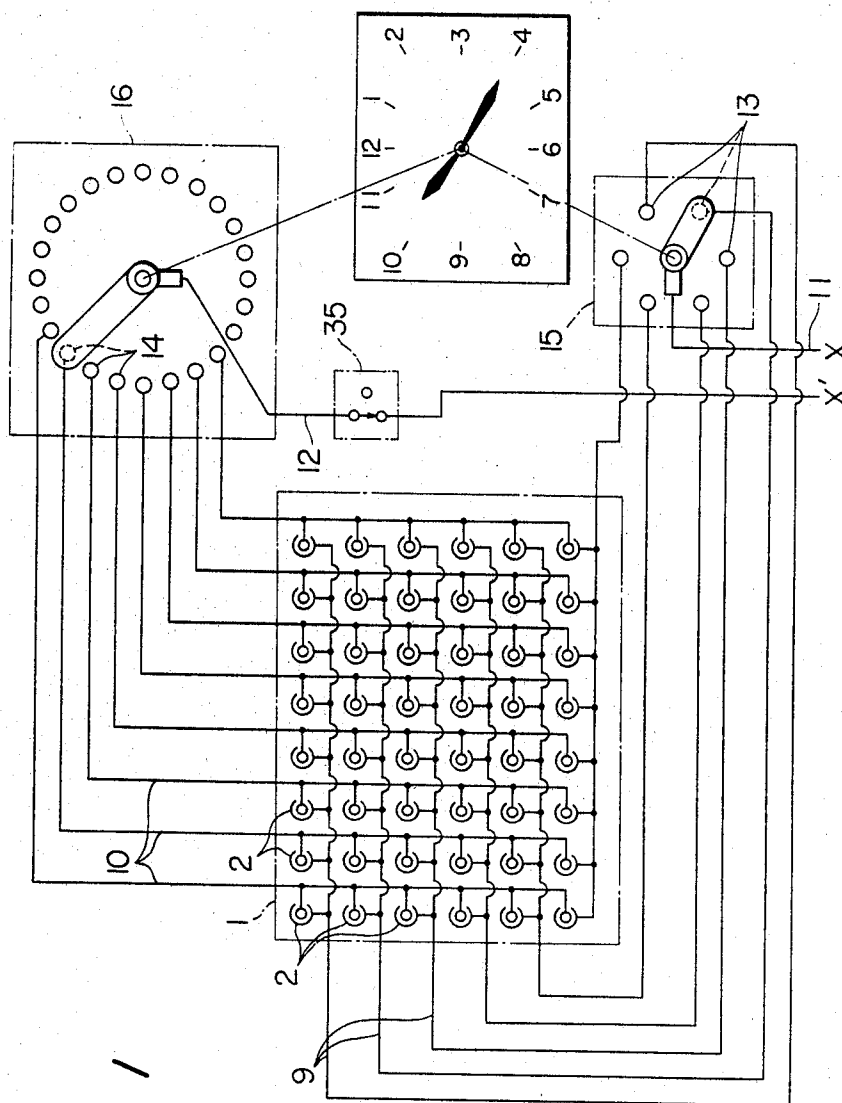


Fig. 1

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3,475,747

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Fig. 2 Fig. 3 Fig. 4 Fig. 5A

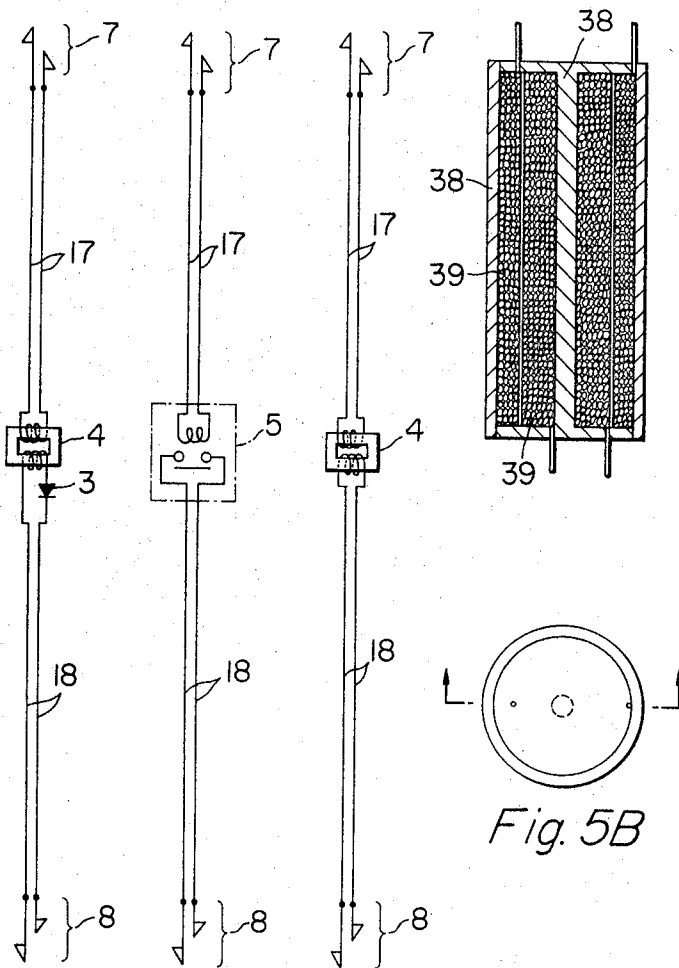


Fig. 5B

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3,475,747

Original Filed March 3, 1965

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Fig. 6

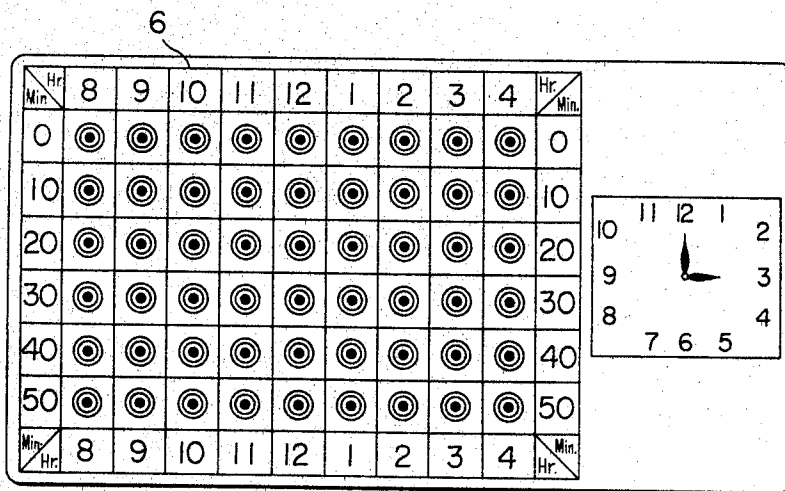
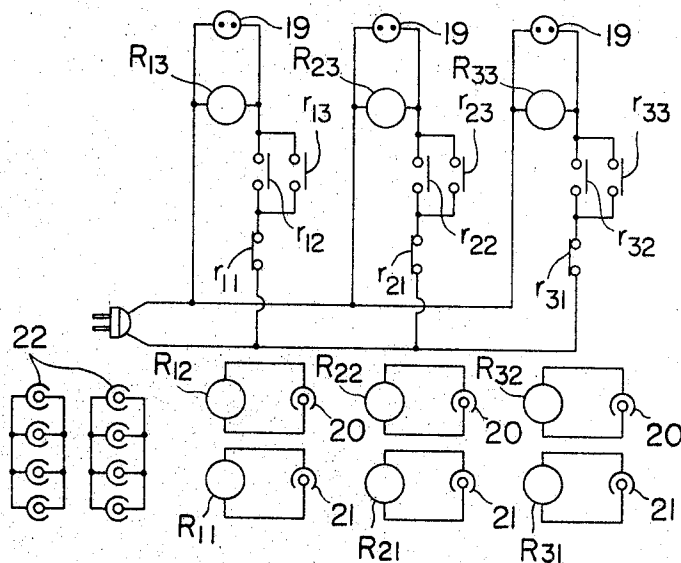


Fig. 7



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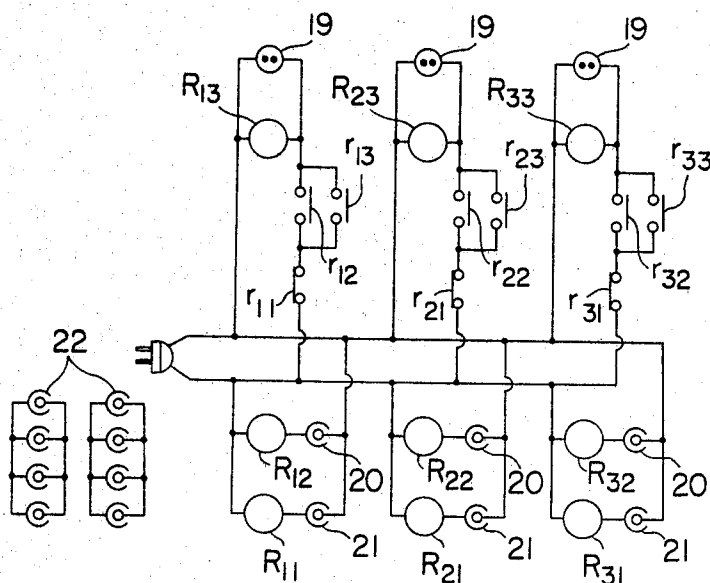
SHUNSEI KRATOMI
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3,475,747

Original Filed March 3, 1965

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Fig. 8



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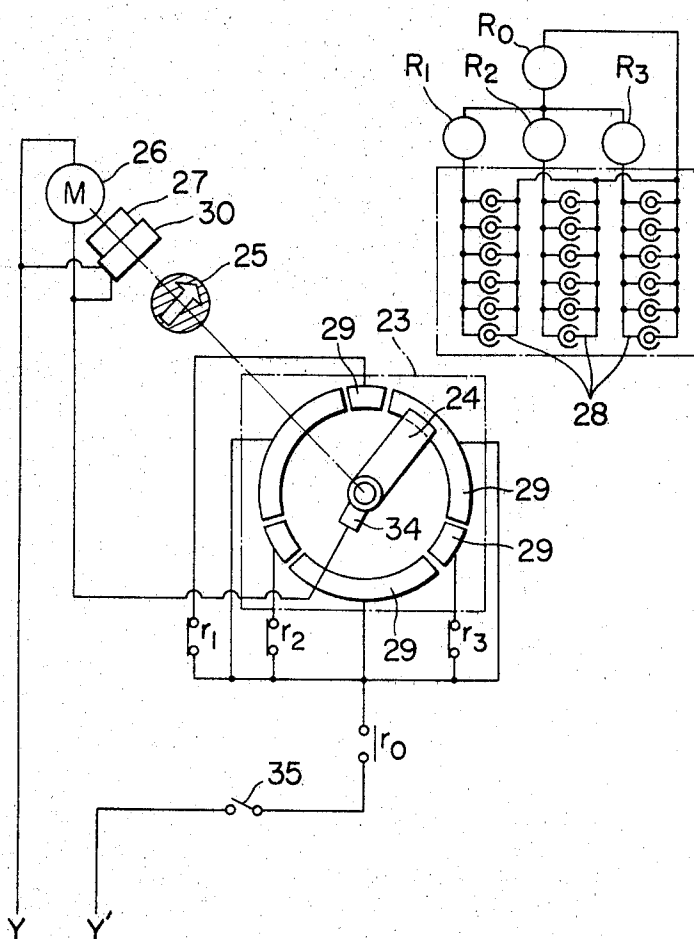
SHUNSEI KRATOMI
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3,475,747

Original Filed March 3, 1965

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Fig. 10



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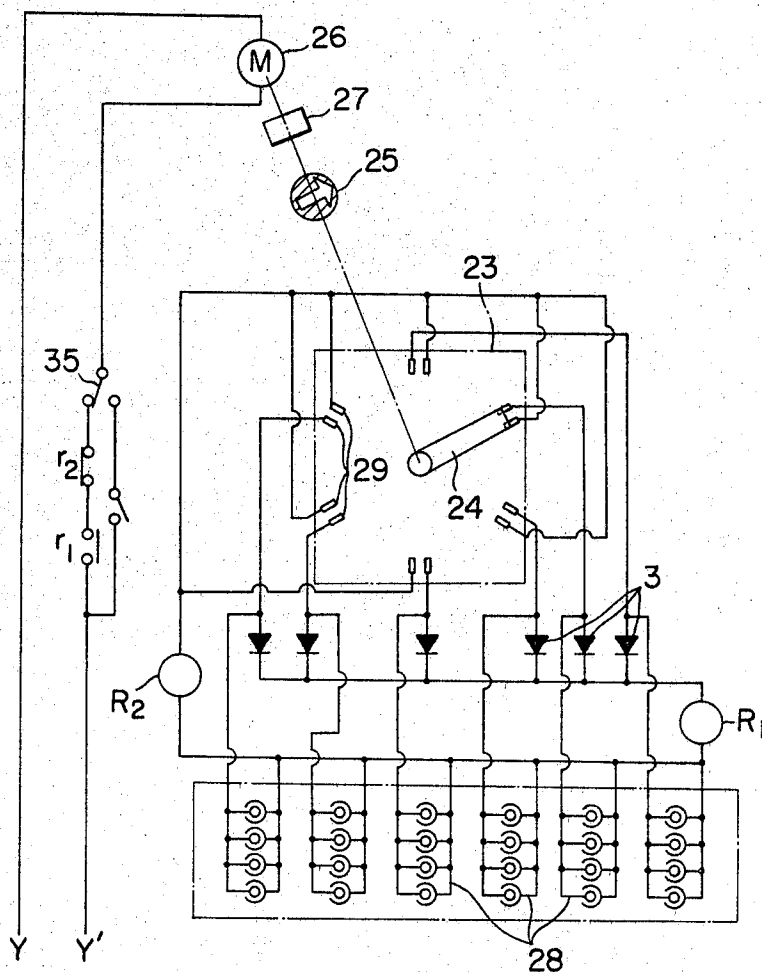
SHUNSEI KRATOMI
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3,475,747

Original Filed March 5, 1965

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Fig. 11



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SHUNSEI KRATOMI
AND-CIRCUIT-CONTROLLED PROGRAM SWITCH
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3,475,747

Original Filed March 3, 1962

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Fig. 13

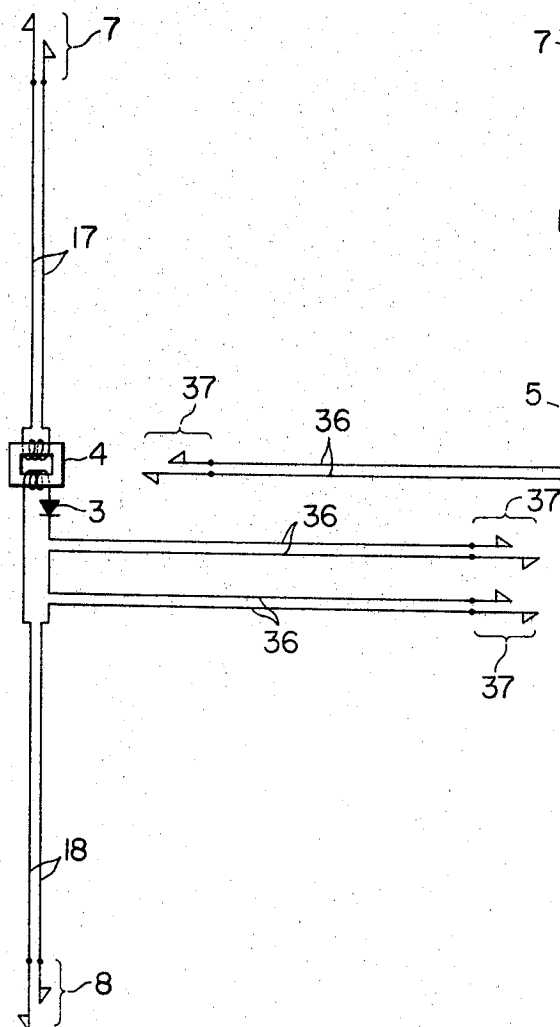
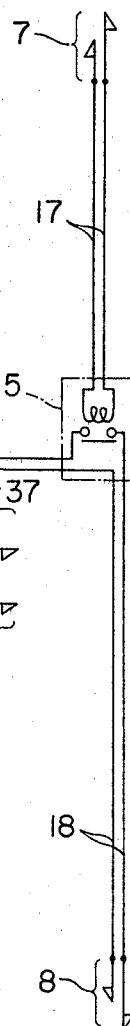


Fig. 14



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3,475,747

Original Filed March 3, 1965

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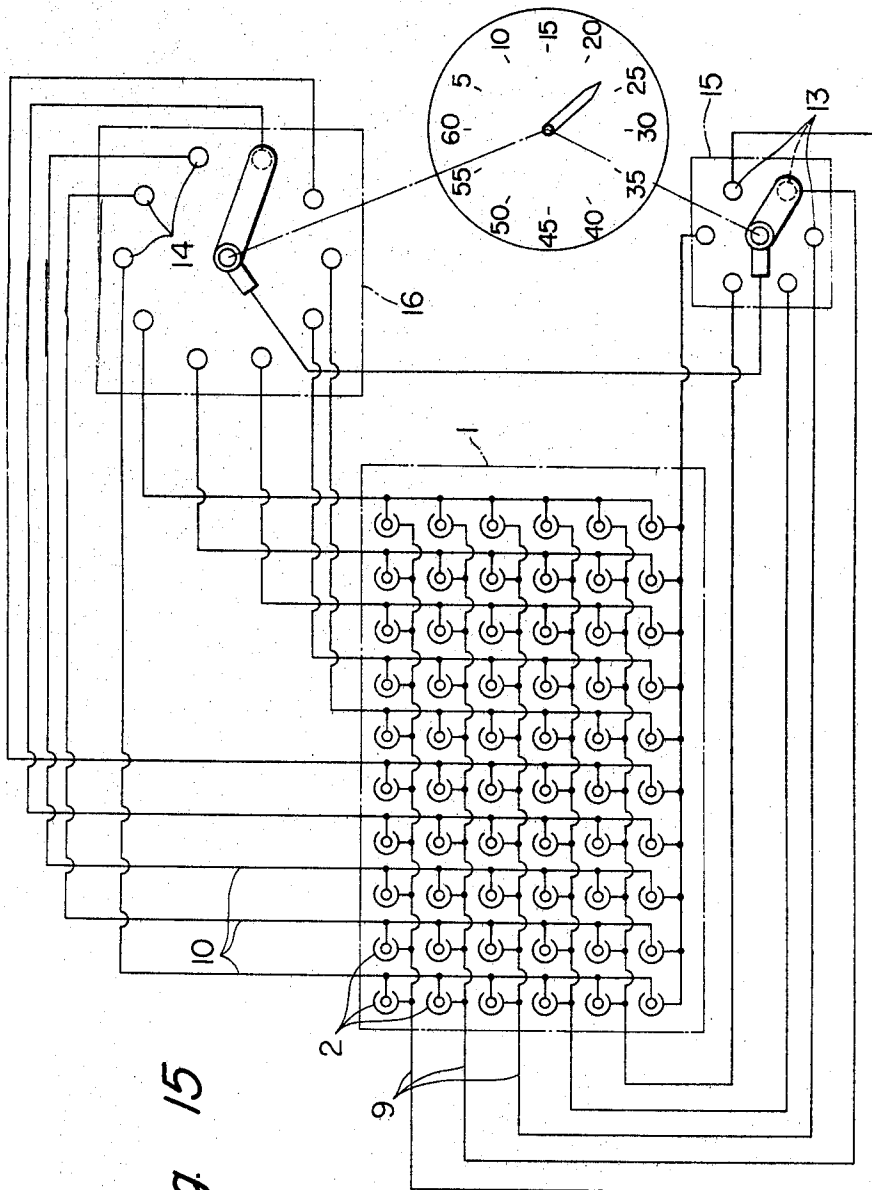


Fig. 15

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3,475,747

**AND-CIRCUIT-CONTROLLED PROGRAM SWITCH
HAVING MATRIX OF CORD CONNECTORS**Shunsei Kratomi, 39-723 Jingumae 2-2, Shibuya-ku,
Tokyo, JapanContinuation of application Ser. No. 436,743, Mar. 3,
1965. This application Aug. 30, 1966, Ser. No. 588,642Claims priority, application Japan, Mar. 7, 1964,
39/12,506, 39/12,508, and 39/12,509; Jan. 1,
1965, 40/1,359, 40/1,360, and 40/1,362

Int. Cl. G08b 1/00; H02j 9/02

U.S. Cl. 340-309.4

19 Claims

ABSTRACT OF THE DISCLOSURE

A two-dimensional timer-controlled program switch wherein the row buses of a matrix are connected to a first cyclically operable switch and the column buses of the matrix are connected to a second cyclically operable switch. Two-pole jack are connected at each cross-point of the matrix. Connecting cords having their input isolated from their output are provided for connecting a utilization circuit to a selected jack which is connected to an energy source when the cyclical switches simultaneously contact the row and column buses corresponding to the selected jack.

The present application is a continuation of my prior application U.S. Ser. No. 436,743, filed Mar. 3, 1965, now abandoned.

The present invention relates to an AND-circuit controlled program switch, and to connecting cords for use in control circuitry; and more particularly to a program switch which controls electrical signals for application to utilization circuits at predetermined times, as desired and as set beforehand, in connection with the particular program selected.

The number of utilization circuits which can be controlled by the program switch of the present invention can be of any number; any cycles of the operation of the switch can be used for control. The interconnection is simple and easily accomplished by means of the connecting cords; the apparatus uses only inexpensive readily available components, is highly reliable, and simple in design. The program itself can readily be changed, and any number of specific programs can be set easily.

Selective control of the program is obtained by means of connecting cords, using two-pole plugs in combination with two-pole jacks; a special cord in accordance with the invention, and which is particularly useful with the AND-circuit controlled switch contains a diode, an induction coupler, or a reed relay.

It is an object of the present invention to provide an AND-circuit controlled program switch capable of controlling a number of utilization circuits, selectively, during a cycle of its operation; and to provide components for use with signal transfer, for example as derived from such a program control switch, which are readily adaptable to a variety of functions and are efficient and easy in their use.

The structure, organization and operation of the invention will now be described more specifically in the following detailed description with reference to the accompanying drawings, in which:

FIG. 1 is a schematic diagram of an embodiment of the AND-circuit in accordance with the invention;

FIGS. 2, 3 and 4 show connecting cords of the invention;

FIGS. 5A and 5B provide a cross-sectional view of the induction coupler used in the cords of this invention;

FIG. 6 is a programming board;

FIGS. 7 and 8 show two embodiments of holding circuits;

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FIGS. 9 to 12 show various embodiments of automatic angular displacement control units in accordance with the invention;

FIGS. 13 and 14 show connecting cords with tertiary lead wires of the invention, and

FIG. 15 is a schematic diagram of an embodiment of a secondary AND-circuit constituted in accordance with the invention.

Briefly, in accordance with the present invention, the AND-circuit controlled program switch utilizes a matrix circuit having row buses and column buses; two-pole connectors in the nature of jacks are arranged at the intersections of the row and the column buses, with one pole of the jack being connected to a row and the other to the column bus respectively. A pair of cyclically operable switches, such as timer switches, which are synchronized in their operation, are connected to the row, and the column bus respectively. The timer switches may, in turn, be connected to a source of potential, or may be connected together if a source of power is supplied to the jacks rather than to be supplied from the timers to the jacks for a further utilization elsewhere.

Plug-cords are provided for plugging into the jacks. These plug-cords consist of a pair of primary wires, each with a plug, and a pair of secondary wires, each connected to a plug. The primary and secondary wires are interconnected by electrically isolating connection units, such as transformers, relays, induction couplers and the like; for certain applications, a diode may be inserted in series with a primary, or secondary wire, to prevent spurious circuit paths.

The jacks, of a matrix, may be connected directly to a utilization circuit; or, connecting cords including a third, or tertiary pair of connecting wires may be used, which have their own plug at the ends thereof; these third, or tertiary pair of wires are connected in series with the aforesaid secondary pair of wires. The plug end of the tertiary pair of wires may be connected to an additional timer-controlled matrix circuit similar to the one above referred to, thereby greatly extending the time period which can be controlled by cascading time steps.

A plurality of connecting cords, may, of course, be utilized and plugged into various jacks; some of these plugs may be connected to relays, in turn, which may include holding circuits to provide ON-OFF operation at predetermined times. The timing itself can readily be changed by changing the plug connection to the jacks of the matrix circuit.

Referring now to the drawings, and in particular to FIG. 1: a matrix circuit 1 has a series of row buses 9 and column buses 10; at their intersection, two-pole connectors 2 are provided for use with special connecting cord shown in FIG. 2 to FIG. 4. The connecting cords may contain a diode 3 (FIG. 2) with or without an induction coupler 4 (FIG. 4) or a reed relay (FIG. 3). The two-pole connectors of the matrix circuit are arranged on a programming board 6 in orderly fashion, as shown in FIG. 6. Special connecting cords having a first, or primary two-pole plug 7 at the primary end, and a secondary two-pole plug 8 at the other end are used for electrically connecting utilization circuits to the matrix circuit.

The row buses 9 are connected to a main bus 11 through a row-bus switch 15. The column buses 10 are connected to a main bus 12 through a column bus switch 16. Main buses 11, 12 are connected to terminals X-X'. With respect to the jacks 2, switches 15, 16 constitute an AND-circuit.

The row-bus switch 15 has contacts 13; column-bus switch 16 has contacts 14. The contacts are arranged to be driven by a clock, with each elemental switch contact

being closed successively at constant intervals of time, and opening shortly before the next contact is closed to repeat switching action with a constant cyclical period. The switches 15, 16 are synchronized together, as indicated by the dash-dot lines interconnecting the clock with the switch units. The clock switch preferably utilizes a combination of a stepping rotary switch and a pulse motor, controlled by clock pulses, as shown schematically in FIGS. 1 and 15; however, no restriction is placed on the invention with respect to the type of switch involved.

Row-bus clock switch 15 and column-bus clock switch 16 are synchronized in such a manner that the period of a complete cycle for the row-bus clock switch 15 coincides with the time interval that a contact 14 is connected to column line 10 by the column-bus switch 16. In FIG. 1, matrix circuit 1 has 6 row-buses 9 and thus also six contacts 14; there are eight column-buses 10, and connections to eight contacts 14. If the dwell time of the contacts 13 is ten minutes, and the cycling of the row-bus clock 15 is one hour, the column-bus clock 16 should have dwell times of one hour on each one of the contacts 14, that is should step in one hour intervals, completing a cycle in eight hours. Of course, any number of column buses and row buses can be used to provide for any number of time periods and time cycles.

A two-pole jack 2 is, at the same time, connected to the main buses 11, 12 only once in any cycle of performance of both of the clocks 15, 16, that is when both the associated row-bus switch contact 13 and column-bus switch contact 14 is closed at the same time, thus forming the AND-function. Each jack 2 of the matrix circuit, as arranged on programming board 6, thus has a specific time when it is connected to terminals X-X' through the main buses 11, 12. Terminals X-X' may be further connected to a power source.

The total circuit functions as an AND-circuit controlled program switch when cooperating with the special connecting cords shown in FIGS. 2-4 respectively.

The programming procedure for a system of the present invention is by simply connecting a two-pole jack of the matrix circuit, which corresponds to a desired time for excitation, to the utilization circuit by means of the connecting cord. The connecting cord illustrated in FIG. 2 consists of a first, or primary two-pole plug 7, primary lead wires 17, secondary lead wires 18, a secondary two-pole plug 8, and a component to isolate the primary wire 17 and the secondary wires 18 from each other electrically, while still providing for signal transfer. In FIG. 2, this device is an induction coupler 4 which transmits electrical signals from the primary lead to the secondary lead wire. A diode 3 is further inserted into the secondary wires. The operating principle and the basic structure of the induction coupler are the same as those of an ordinary transformer; its major function is to provide a closed loop to signal current at the primary side and to isolate the secondary lead wires 18 from the primary wires 17. The induction coupler may, of course, also act as a transformer by suitable choice of turns ratio of its windings. The induction coupler 4 for the connecting cords should be as small and compact as possible for easy handling. FIG. 5 shows such a coupler in cross-section. It has a central, and circumferentially closed magnetic path 38, using a cylindrical shell, and end discs to close the magnetic circuit. Shell and disc also protect windings 39 from mechanical damage as well as stray magnetic interference. The primary and the secondary windings shown in FIG. 2 may be wound on the coupler of FIG. 5 either concentrically around a central core, or side by side, as desired.

Diode 3 inserted in the secondary lead wire 18, in combination with an induction coupler 4, is a desirable component to prevent feedback interference between utilization circuits which are connected to the same jack of the matrix circuit, and which are further connected by other connecting cords to other jacks of the matrix, for example when repeated excitation of the same utilization circuit at repeated times is desired.

In order to avoid misconnection of the cords, the primary plug 7 of the cords should preferably be of a different size or shape than the secondary plug 8; further, the sheaths of the primary cords 17 are preferably of a color which is different from the sheaths 18 of the secondary. The connecting cord of FIG. 3 illustrates a cord using a miniature relay, such as reed relay 5. Reed relay 5 replaces both diode 3 and induction coupler 4 of the cord of FIG. 2. It may have normally open, or normally closed contacts, depending on the function of the circuit to be controlled. Both cords of FIGS. 2 and 3 can isolate the utilization or load circuit from the primary plugs 7 and the jacks to be associated therewith, and may thus be used practically anywhere. A simpler cord as shown in FIG. 4, and not providing for such isolation, contains only an induction coupler 4, and may be used for limited purposes. It is identical to the cord of FIG. 2 except that the diode 3 is lacking. In programming utilization of the circuit using cord 4, a different circuit may be excited repeatedly, or different circuits may be excited at individually non-overlapping times; it is not possible, however, to excite a number of utilization circuits repeatedly and in such a manner that there is overlap between two or more time periods of excitation. For such programming, the cords of FIG. 2 or FIG. 3 must be used to prevent undesirable spurious circuit paths. To provide for excitation of multiple utilization circuits, at the same time, the jacks 2 at the intersection of row and column buses 9, 10 can be arranged to accept more than a single cord, or a plurality of such jacks can be provided, in parallel; or the plugs 7 can be arranged to accept an additional plug, in parallel, while at the same time forming connecting points for primary lead wires 17. All such components are well known in the electrical art.

FIG. 7 shows the connection of the control circuit of the present invention to a utilization circuit. Both diagrams of FIGS. 7 and 8 illustrate a complete set of holding circuits which may be used in combination with the AND-circuit control program switch of FIG. 1, and further with the connecting cords as shown in FIGS. 2-4, 13 and 14. Because the signal produced in the program switch of the present invention continues only for a limited period of time, auxiliary circuits to hold the connection of power circuits after the signal from the program switch has gone off, is necessary, in order to provide for an extended period of ON-operation, and for a switching the appliance OFF, as determined by the control.

19 illustrates a plug to be plugged into the socket of a power source; sockets 19a, 19b, 19c, are sockets into which electrical appliances, to be controlled, can be plugged. Jacks, into which secondary plugs 8 of connecting cords for transmitting ON-signals are shown at 20a, 20b, 20c. 21a, 21b, 21c, are jacks into which secondary plugs 8 of connecting cords for transmitting OFF-signals can be plugged. 22 are groups of spare jacks to supplement any one of the jacks 20a, 20b, 20c; 21a, 21b, 21c, to be connected to any one of them by means of conventional connecting cords and to provide for additional capacity by parallel connections.

R₁₂, R₂₂, R₃₂, are coils of connecting relays; r₁₂, r₂₂, r₃₂, are the contacts of connecting relays; R₁₁, R₂₁, R₃₁ are coils of disconnecting relays; r₁₁, r₂₁, r₃₁, are the contacts of disconnecting relays. R₁₃, R₂₃, R₃₃, are coils of holding relays and r₁₃, r₂₃, r₃₃, are contacts of holding relays. Although it may be, theoretically, possible to utilize the connecting cords of FIG. 3 to replace fixed relays indicated with the "R" and the "r" designation in the diagram of FIGS. 7-12, it may be impractical to do so because the switching capacity of reed relays, and particularly of reed relays within connecting cords, may be too small to be part of the current path for an appliance circuit. Thus, conventional plug-in relays are preferred.

Assume that a jack 2 of FIG. 1 connected to jack 20c of FIG. 7 by means of a connecting cord of FIG. 2,

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FIG. 4 or FIG. 13, or connected to jack 20c of FIG. 8 by means of a connecting cord of FIG. 3 or FIG. 14, is energized; relay coil R_{32} will close the connection r_{32} - r_{31} , shown normally closed, remains closed, and current may flow from plug 19 to appliance outlet, as well as to holding relay coil at R_{33} , causing r_{33} to remain closed thus forming a holding circuit and permitting continuing current supply from plug 19 to socket 19c even after excitation of row lines 9 and column lines 10 (FIG. 1) and thus, supply of current to relay R_{32} has terminated. To break the connection, energizing relay R_{31} , connected to jack 21c will cause opening of normally closed contacts. Relay contacts r_{33} will drop out, and later reclosing of r_{31} , when the simultaneous excitation from the appropriate row and column lines has terminated, will not cause reconnection of socket 19c, due to the interruption of the circuit at r_{33} and r_{32} .

When the spare jacks 22 are used, one of them in a group is connected to the jack that needs interconnection, by means of a conventional connecting cord, or a cord shown at FIG. 4. Then, the other spare jacks in the same group can be connected to jacks of an AND-circuit by means of any one of the cords shown in FIG. 2-FIG. 4, or of FIG. 13. The concept of using the spare jacks in parallel, in groups, is also applicable to the AND-circuit, if simultaneous excitation is required for more than one utilization circuit. Conventional connecting cords may again be used.

The circuit shown in FIG. 8 is generally similar to that of FIG. 7. For isolation, connecting cords using the relay contacts as shown in FIG. 3, or FIG. 14 are, however, required.

FIGS. 9-12 illustrate various circuits useful in combination with the control switch of the present invention, and particularly with automatic angular displacement control units. One of the most useful applications of the present invention is an automatic channel selector for television or radio use.

The circuits illustrated in FIGS. 9-11 are connected to the AND-circuit of FIG. 1 by means of connecting cords shown in FIGS. 2, 4, or FIG. 13. The circuit of FIG. 12 is connected to the AND-circuit by means of cords of FIG. 3, or FIG. 14, respectively. Each of the circuits of FIGS. 9-11 includes a rotary switch 23 having a travelling contact 24 rotating in coincidence with the rotation of a utilization device 25, shown as an indicator, and driven by a motor 26 through a set of reduction gears 27 as schematically indicated by the dash-dot line. Groups of jacks 28 receive signals for angular displacement of the motor, and with it of indicator 25 and contacts 24. The displacement corresponds to a fixed contact 29 of the rotary switch 23. A power source Y-Y' for the motor 26 is provided, connected through relay contacts r_1 . The embodiment of FIG. 10 is generally similar; it utilizes a magnetic clutch 30. FIG. 11 shows yet another embodiment utilizing diodes 3'. A selected group of jacks 32 (FIGS. 9 and 12) can be arranged to receive "OFF" signals for a main circuit 33 associated with device 25 (FIGS. 9-12). Further, an automatic-manual changeover switch 35 may be provided, as well as a separate power source Z-Z' for circuit 33 associated with indicator 25. The common connection to the rotary switches 24 is by a brush 34.

Each fixed contact 29 of the rotary switch, to which a group of jacks pertains, corresponds to an angular displacement of indicator 25. When a signal for a new angular displacement is received, as determined by the timing and plug arrangement of the AND-circuit of FIG. 1, for example, motor 26 drives travelling contact 24, and with it the indicator 25, until it takes a new angular position, as commanded by the signal from the jack and connecting cord.

The following nomenclature is employed in connection with the diagrams of the drawings: R: relay coil; r: relay contact. Subscripts: "1"—Motor Connecting Relay; "2"—

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Motor Disconnecting Relay; "3"—Holding Relay for Utilization Circuit 33; "4"—Connecting Relay for Utilization Circuit 33; "5"—Disconnecting Relay for Utilization Circuit 33.

The "R", "r" designations may use the cords of FIG. 3. As explained in connection with FIGS. 7 and 8, however, plug-in relays may be used in certain applications when required by the current to be carried. It is to be noted that some of the relay contacts are normally open, and some normally closed; and a cord to be associated with the combination "R-r" should have a pair of relay contacts and not only one. The three positions of switch 35 are automatic-manual-OFF. The utilization device 25 may be a rotary channel selector with an indicator. The main circuit 33 may then be a television, or radio apparatus, or a combination of both.

The operation of the circuit of FIG. 9 will be clear: any one of the cords of FIGS. 2, 4 or 13 may be plugged in from the jacks 2, FIG. 1, to any one of the jacks 28; a plurality of jacks are shown in parallel to permit energization from a plurality of cords, and plugs, that is at any number of times. When a circuit is established from brush 34, rotary contact 24, to a stationary contact 29, then to a jack 28 and return through connecting relay coil R_1 , to brush 34, and a signal is applied from the AND-circuit of FIG. 1, relay contact r_1 will pull in, energizing the motor 26 to turn, thus moving the indicator, and simultaneously the rotary switch 24. Due to the holding circuit R_3 - r_3 , utilization device 33 will be connected even after the signal stops. By providing a gap 24', in the rotary switch contacts, the motor can be made to stop by itself in a predetermined position depending on which one of the groups of plugs 28 were originally connected, and the persistence of the signal from the AND-circuit controlled switch of FIG. 1. Electrical appliance 33 to which the utilization device 25 pertains is connected to power source Z-Z', when a signal for an angular displacement is delivered to any of jacks 28, and is kept connected with the power source by a holding relay R_3 - r_3 until a STOP signal is delivered to one of jacks 32.

In the circuit of FIG. 10, only half of the fixed contacts of the rotary switch relate to the groups of jacks 28 in a one-to-one correspondence; the other half provides continuous current so long as connecting relay contact r_1 is closed, to rotate motor 26. The notation is similar to that previously used; R is a relay coil and r is the associated relay contact.

Again, the jacks 28 receive secondary plugs 8 of the connecting cord of FIGS. 2, 4 or 13. Connecting relay R_1 has a normally open contact r_1 and is directly excited with the displacement signal transmitted through the connecting cord, to connect motor 26 to a power source Y-Y'. Disconnecting relays R_{2a} , R_{2b} and R_{2c} , each with their associated normally closed contacts r_{2a} , r_{2b} and r_{2c} , are directly excited with the displacement signal transmitted through the connecting cord. The coil R_2 of the disconnecting relay of each connecting cord is associated with a group of jacks 28, and the contacts r_2 with a fixed contact 29 of the rotary switch 23.

In the circuit of FIG. 11, the contacts are formed in pairs, each pair corresponding to one of the groups of jacks 28 and to a step of displacement of the indicator 25. Again, a rotary switch 23 has fixed contacts 29 and a travelling contact 24 driven in synchronism with the position of the utilization device 25, by a motor 26 through a gear 27. The two-pole jacks 28 receive secondary plugs 8 of a connecting cord, each one of the jacks 28 pertaining to a pair of fixed contacts 29 of the rotary switch.

A connecting relay R_1 , having a normally open contact r_1 , is directly excited by the displacement signal transmitted through the connecting cords, to connect motor 26 to power source Y-Y'. A disconnecting relay R_2 , with normally closed contact r_2 , is provided, directly excited with the displacement signal transmitted through the con-

necting cords to disconnect the motor from the power source when the travelling contact reaches a respective pair of fixed contacts. Diodes 3' are provided, each pertaining to a pair of fixed contacts of the rotary switch and connected in series with the coil of the connecting relay R₁, and in parallel with the coil of the disconnecting relay R₂. The diodes are poled similarly, and eliminate adverse interconnections (sneak paths) between fixed contacts 29. Further, the diodes enable the travelling contact 24 to continue to rotate even though a pair of stationary contacts are bridged as contact 24 rotates.

FIGS. 13 and 14 illustrate special connecting cords useful in certain embodiments of the present invention. The connecting cord of FIG. 13 has one, or two tertiary leads 36, added in series to the secondary lead wire 18 of the cord of FIG. 2. In the cord of FIG. 14, a tertiary lead wire 36 is added in series to the secondary lead wire of that of FIG. 3. The tertiary lead wire has a two-pole plug 37 at its end and is adapted to be connected to a clock switch circuit synchronized with the other clock switches of FIG. 1, so that the total combination of the AND-circuit of the primary side and the clock switch circuit including secondary AND-circuit as shown in FIG. 15 and connected to the tertiary plugs 37 form an integrated-AND-circuit of a higher order, that is requiring a higher order of coincidence of events. FIG. 15 shows the AND-circuit for use in connection with tertiary cords of FIGS. 13 and 14; it differs from that of FIG. 1 in that the main bus 11 for the rows, and the main bus 12 for the columns are connected together; the electrical equivalent to FIG. 1 is short-circuiting the terminals at X-X'. In operation, if column-bus switch contacts 14 of the secondary AND-circuits of FIG. 15 step forward at one-minute intervals, and row-bus switch contacts 13 of the same circuit step forward at ten-minute intervals, and the circuit is connected to row-bus switch contacts 13 of the AND-circuit of FIG. 1, stepping forward at one-hour intervals; and the eight-column-bus switches 14 of the AND-circuit of FIG. 1 step forward at six-hour intervals, for example, by means of the connecting cord illustrated in FIGS. 13 and 14 respectively, then the total circuit will function as an integrated AND-circuit controlled program switch for a utilization circuit, with a cyclical period of forty-eight hours, yet permitting programming at a minimum interval of one minute. As seen from the above example, connecting cord of FIG. 13 needs to have only one tertiary lead wire; alternatively, one of its tertiary lead wires may be short-circuited, or connected to a short-circuited two-pole jack.

The present invention inherently has several advantages, resulting in its high potential for application and use in various fields. It has high reliability and good economy, owing to its simple construction as well as to the omission of complicated or delicate components. The programming procedure is simple, and can readily be changed; no interference between plug cords will arise when the program is modified during operation. Repetitive or cyclic use is easily achieved; if a subsequent program is quite similar to a previous one, however, a minimum amount of effort is required to modify the programming, due to the non-destructive patch cord memory mechanism. If the clock switches have adjustable speed, or adjustable cyclic rate, a change of period of a cycle for the programming switch may readily be done by mere speed change or adjustment of the clock switches.

The AND-circuit of the present invention is very flexible, because the following design factors are independent of each other:

(a) The minimum interval of time for programming.

(b) The numbers of the row buses and column buses of the matrix circuit; this feature provides the program switch of the present invention with a practically unlimited range of variety in the period of a cycle and with minimum interval of programming.

(c) The classes of power sources for the program switch and for the utilization circuits can be determined independently of each other.

I claim:

1. An AND-circuit-controlled program switch comprising:

a matrix circuit having row buses and column buses; a plurality of two-pole connectors, each one being arranged at an intersection of said row and column buses, one pole of each connector being connected to a row, and the other to a column bus respectively; a pair of terminals; first cyclically operable switch means connected to one of said terminals and cyclically connectable to a row bus; second cyclically operable switch means connected to the other of said terminals and cyclically connected to a column bus; said first and said second cyclically operable switch means being synchronized, and said individual two pole connectors being connected to said pair of terminals upon simultaneous connection of the row and column buses corresponding to said individual two pole connectors by said switch means; and connecting cords connected to said two-pole connectors for further connection of utilization circuits with said two-pole connectors of the matrix circuit.

2. Switch as claimed in claim 1 wherein said connectors form jacks, and said connecting cords consist of a primary two-pole plug, a pair of lead wires, and a secondary two-pole plug.

3. Switch as claimed in claim 1 wherein the connecting cord includes a primary two-pole plug adapted for association with said two-pole connectors, primary lead wires, secondary lead wires, and a secondary plug; and means interconnecting while electrically isolating said primary and said secondary lead wires and while providing for signal transfer therebetween.

4. Switch as claimed in claim 3, wherein said connecting cord further includes at least one pair of tertiary lead wires, each pair having a two-pole plug at one end, the other end of said tertiary lead wires being connected in series with the secondary lead wires.

5. Switch as claimed in claim 1, wherein the terminals are connected to an alternating current source; and said connecting cord includes a primary two-pole plug associated with said two-pole connectors, primary lead wires, secondary lead wires, and a secondary plug; and an induction coupler interconnecting said primary and said secondary lead wires and isolating them electrically while transmitting electrical signals from the primary lead wires to the secondary lead wires.

6. Switch as claimed in claim 5 wherein said connecting cord further includes a diode inserted in one of the lead wires.

7. Switch as claimed in claim 6 wherein said diode is inserted in one of the secondary lead wires.

8. Switch as claimed in claim 6 wherein said connecting cord further includes at least one pair of tertiary lead wires, each pair having a tertiary two-pole plug at one end, the other end of said tertiary lead wires being connected in series with said secondary lead wires.

9. Switch as claimed in claim 1, wherein terminals are connected to a power source; and said connecting cord includes a primary two-pole plug associated with said two-pole connectors, primary lead wires, secondary lead wires and a secondary plug, and a relay, the coil of said relay being connected to said primary lead wires; the relay contacts being connected to said secondary lead wires, thus interconnecting said primary and said secondary lead wires and isolating them electrically while transmitting electrical signals from the primary lead wires to the secondary lead wires.

10. Switch as claimed in claim 1 wherein said terminals are short-circuited.

11. Switch as claimed in claim 4 including a further AND-circuit controlled program switch as defined in

claim 9, wherein one of said tertiary two-pole plugs is connected to a connector of said further AND-circuit controlled program switch; and all the cyclically operable switch means of both said AND-circuit controlled program switches at the primary and the tertiary sides of said connecting cord being synchronized.

12. Switch as claimed in claim 1 in combination with a holding circuit comprising a power inlet plug, power outlet sockets to receive separable plugs for utilization circuits, ON-signal sockets and OFF-signal sockets to receive secondary plugs of said connecting cords and ON-signal relays having normally open contacts; OFF-signal relays having normally closed contacts, the coils of said ON-signal relays and said OFF-signal relays being connected to be actuated by signals transmitted through said connecting cords, and said ON-signal sockets and said OFF-signal sockets; and holding relays having normally open contacts energized by power from said power inlet plug to connect the power source upon an excitation of respective ON-signal relay, hold the connection, and cause disconnect upon an excitation of respective OFF-signal relay as determined by said AND-circuit controlled switch.

13. Switch as claimed in the combination of claim 12, wherein at least one of said connecting cords further includes primary lead wires, secondary lead wires, an induction coupler inter-connecting said primary and said secondary lead wires and isolating them electrically while transmitting electrical signals from the primary lead wires to the secondary lead wires, and a diode inserted in one of the lead wires.

14. Switch as claimed in claim 13 wherein said diode is inserted in one of the secondary lead wires.

15. Switch as claimed in the combination of claim 12, wherein said connecting cord includes a reed relay, the primary wires being connected to the coil of said relay, and the secondary wires to the contacts of said relay.

16. Switch as claimed in claim 1 in combination with an automatic angular displacement controller for a utilization device, comprising a rotary switch having cooperating fixed contacts and a travelling contact, said travelling contact having less contact points by one than the number of said fixed contacts, means driving said travelling contact in synchronism with said utilization device; a plurality of two-pole jacks, arranged in groups receiving secondary plugs of connecting cords, each group of said jacks pertaining to a fixed contact of said rotary switch; and a connecting relay with a normally open contact connected to have its coil directly excited by displacement signals transmitted by said connecting cords and to have its contacts connect said driving means with a power source.

17. Switch as claimed in claim 1 in combination with an automatic angular displacement controller for a utilization device, comprising a rotary switch having a plurality

of cooperating fixed contacts and a travelling contact, a motor driving said travelling contact driven in synchronism with the position of said utilization device; a plurality of two-pole jacks arranged in groups to receive secondary plugs of connecting cords; a connecting relay having a normally open contact connected to have its coil directly excited by signals transmitted through said connecting cords and to have its contacts connect said motor with a power source upon excitation of the relay; and disconnecting relays each with a normally closed contact connected to have their coils directly excited by said signals transmitted through said connecting cords, the coil of each said disconnecting relay pertaining to a group of said jacks and the contacts pertaining to a fixed contact of said rotary switch.

18. Switch in the combination claimed in claim 17 wherein said fixed contacts on said rotary switch are arranged in pairs; a plurality of diodes are provided each pertaining to a contact, each, of said pairs of fixed contacts of the rotary switch, said diodes being connected in series with the coil of said connecting relay and in parallel with the coil of at least one of said disconnecting relay.

19. Switch as claimed in claim 1 in combination with an automatic angular displacement controller for a utilization device, comprising a rotary switch having a plurality of cooperating fixed contacts, and a travelling contact with less contact points by one than the number of said fixed contacts; a motor; said motor driving said travelling contact in synchronism with the position of said utilization device; a plurality of two-pole jacks arranged in groups to receive secondary plug of said connecting cords, each group of said jacks being connected to, and associated with a said fixed contact of the rotary switch, said jacks in cooperation with respective connecting cords associated with said AND-circuit, forming a parallel switching circuit for said motor.

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U.S. Cl. X.R.

171—97; 307—157; 340—166, 176, 286