

April 6, 1943.

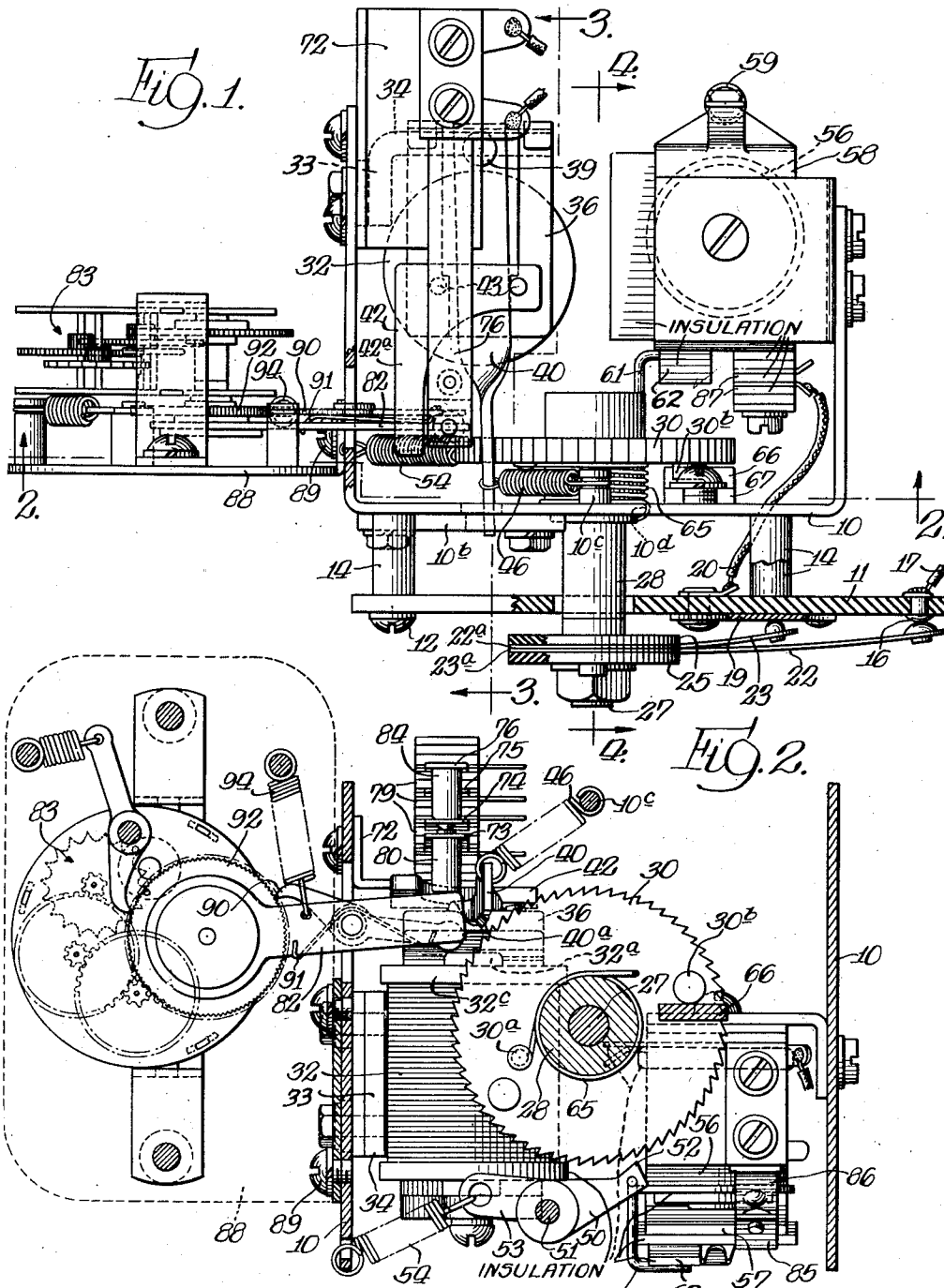
E. G. BAKER ET AL

2,315,920

IMPULSE OPERATED SELECTOR SWITCH FOR ALTERNATING AND DIRECT CURRENT

Filed Oct. 8, 1940

3 Sheets-Sheet 1



BY

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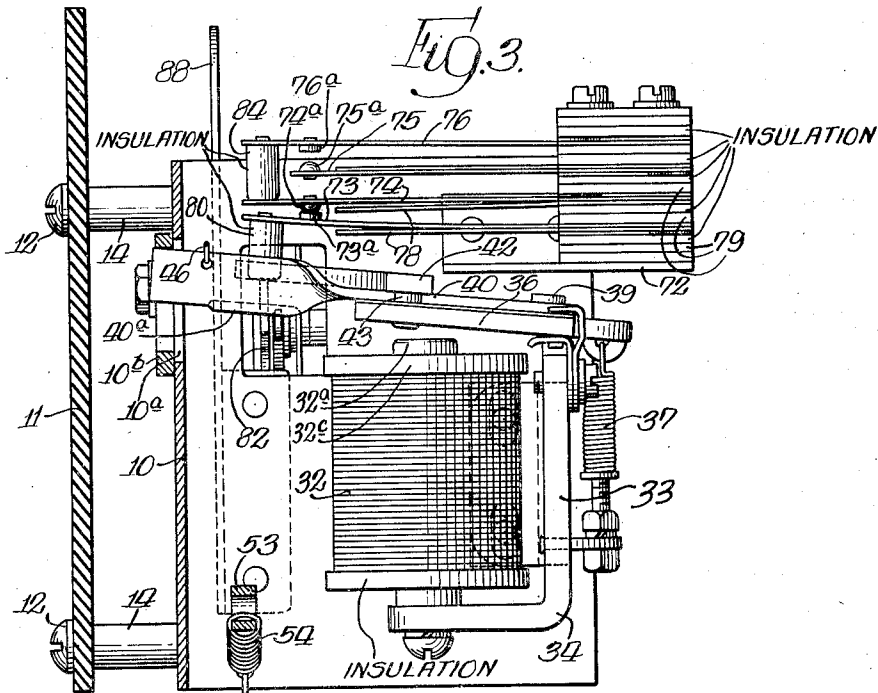
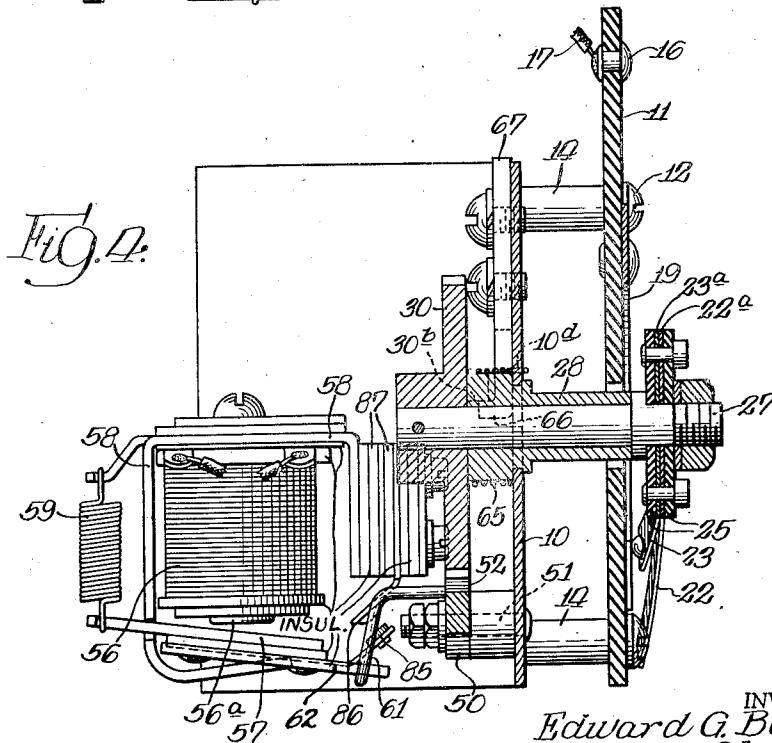
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IMPULSE OPERATED SELECTOR SWITCH FOR ALTERNATING AND DIRECT CURRENT

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 5.

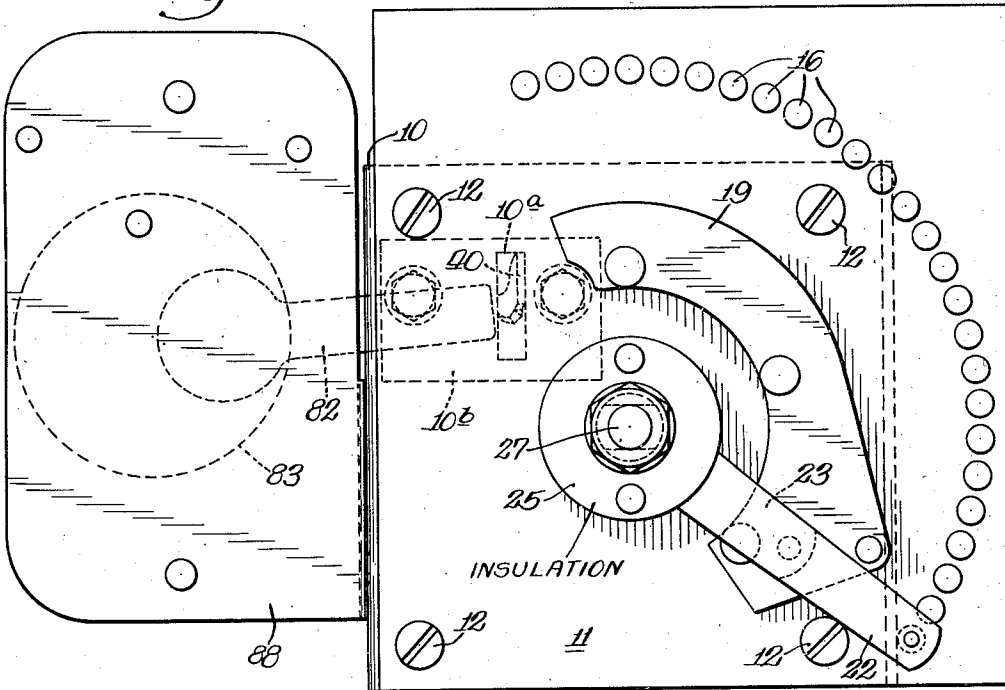
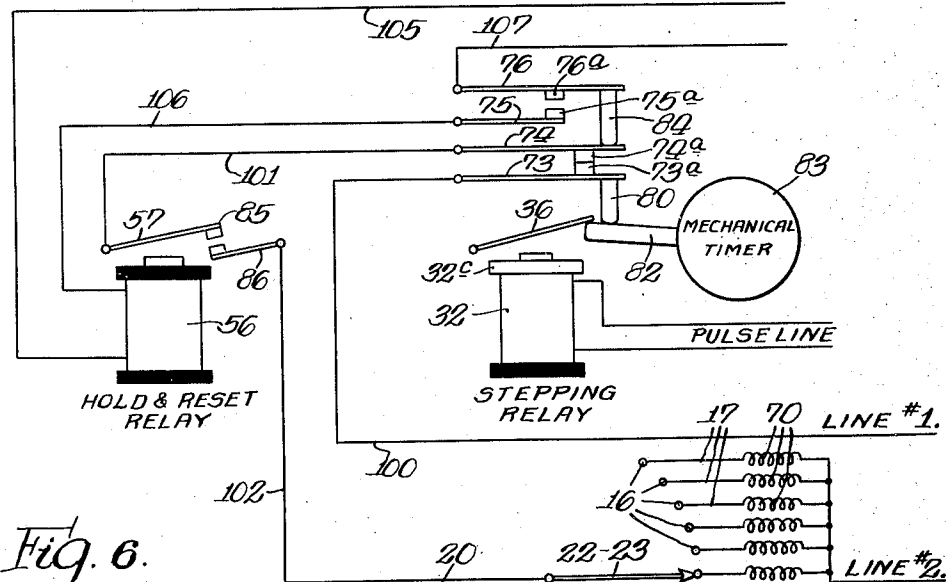


Fig. 6.

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UNITED STATES PATENT OFFICE

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IMPULSE OPERATED SELECTOR SWITCH
FOR ALTERNATING AND DIRECT CUR-
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Application October 8, 1940, Serial No. 360,282

8 Claims. (Cl. 175—375)

This invention pertains to selector switch de-
vices for mechanisms for selectively controlling
the "make" and "break" of portions of different
electrical circuits or branches of a main circuit.
switch devices of this type lend themselves to a
relatively wide field of use in the selective con-
trol directly or remotely of various types of ma-
chines and apparatus.

More particularly, the present invention is di-
rected to selector switch devices of the type
adapted to be actuated in step-by-step fashion
by the intermittent actuation of an electromag-
net, operated by pulsations of electrical current,
for selectively completing portions of one or more
of a plurality of different electrical circuits, or
branches of a main circuit.

One of the primary objects of this invention
is to provide a novel and improved form of se-
lector switch of the character indicated, adapted
for operation either by alternating or direct cur-
rent. Another object is to provide a novel form
of selector switch of the character indicated
adapted for operation by either alternating or di-
rect current under control of a mechanical timing
device, which permits selective completion and
maintenance of an electrical circuit for a timed
interval.

A further object is to provide a novel form of
alternating or direct current operated selector
switch, controlled by a mechanical timing device,
for effecting completion of a portion of a pre-
selected circuit after a timed interval subsequent to
completion of another portion of said circuit.

Still another object is to provide an improved
unitary selector switch of the type indicated
adapted for operation either by alternating or
direct current, under control of a mechanical
timing device associated therewith, for effect-
ing completion of a portion of a preselected cir-
cuit after a timed interval subsequent to com-
pletion of another portion of said circuit by ad-
justment of the selector switch and maintaining
said preselected circuit completed for a timed in-
terval.

Other objects and advantages of this invention
will be apparent from the following description,
taken in connection with the accompanying
drawings, in which:

Figure 1 is a plan view of the unitary selector
switch embodying the present invention.

Figure 2 is a transverse vertical sectional view
through the switch device, taken substantially
as indicated at line 2—2 on Figure 1.

Figures 3 and 4 are vertical sectional views
through the switch device, taken substantially as

indicated at lines 3—3 and 4—4 respectively on
Figure 1.

Figure 5 is a front elevational view of the switch
device showing the selector panel.

Figure 6 is a wiring diagram including the elec-
trical circuits for controlling the operation of the
selector switch.

Referring now in detail to the drawings, the
selector switch device embodying the present
invention includes a main mounting frame 10
formed as a sheet metal stamping in a generally
U-shaped formation. This frame serves as a
mounting for and totally supports all elements
constituting the switch device so as to provide
a unitary structure or assembly.

Connected to the intermediate portion of the
U-shaped frame 10, in spaced apart relation
thereto, and forwardly thereof is a contact panel
11 of insulating material which is rigidly con-
nected to the frame 10 by screws 12 with spacer
elements 14 interposed between the panel and
the frame as may be seen in the drawings. Said
panel is provided with an arcuate series of spaced
apart contact buttons 16, with the heads of said
buttons exposed on the outer face of said panel
and including body portions extending through
the panel with their inner ends, projecting to the
rear of said panel, serving as terminals for con-
nection to conductor wires as indicated at 17,
which wires it may be understood form portions
of different electrical circuits or branch circuits
to be selectively controlled.

Mounted on the front face of the panel 11, con-
centric with the series of contact buttons 16, is
an arcuate contact strip 19 having a terminal
projecting through the panel for connection to a
conductor wire 20 for completing portions of the
different electrical circuits including the respec-
tive contact buttons 16, as will hereinafter be de-
scribed.

Said contact buttons 16 and contact strip 19 are
adapted to be engaged by a pair of yielding con-
tact arms 22 and 23 respectively as may be seen
in Figures 1 and 5 of the drawings. Said arms
are formed as extensions of disc members 22a and
23a, which are mounted in engagement with each
other between a pair of insulating discs 25 and
the assembly of the disc members and the disc
insulating members is fixedly mounted on the
outer end of a shaft 27 which extends through
the panel 11 and is journaled in a bearing 28
which is rigidly supported on the intermediate
portion of the mounting frame 10, as seen in Fig-
ure 4 of the drawings.

The inner end of the shaft projects within the

frame 10 and has rigidly mounted thereon a ratchet wheel 30 adapted to be rotated in step-by-step fashion for effecting similar movement of the contact arms 22 and 23 for sequentially engaging the respective contact buttons 16. Due to the arrangement of the contact arms 22 and 23 it will be apparent that the conductor wire 20 is therefore in series with the particular conductor wire 17 corresponding to the contact button engaged by the contact arm 22 at a given time. In other words, when the contact arm 22 is in engagement with any one of the contact buttons 16, the portion of the electrical circuit connected through said contact button is completed through the contact arm 23, contact strip 19 and the conductor wire 20.

The means for rotating the ratchet wheel 30 in step-by-step adjustments is accomplished by the intermittent energization of an electro-magnet relay 32 supported on one of the legs of the U-shaped frame 10 by means of a bracket 33 which constitutes a lateral extension of the field piece 34 of said relay. As may be seen in the drawings, said relay 32 is disposed with its coil in an upright position and hingedly mounted on the upper end of the upright leg of the field piece 34 is an armature 36 normally urged in an upward direction away from the core 32a of the coil of the relay by means of a coil spring 37 which is connected to the rear or heel end of the armature and to a lug extension on the leg of the field piece 34, as seen in Figure 3 of the drawings.

Pivotally mounted at 39 on a vertical axis on top of the armature 36 adjacent said hinged connection thereof is an actuating pawl 40 formed of flat bar stock and supported directly upon the top of the armature and extending in a direction parallel to the axis of the ratchet wheel 30. The forward end of said bar beyond the armature is twisted at right angles with respect to the main body of the bar so that the lower edge of the projecting portion of said bar is disposed adjacent the toothed periphery of the ratchet wheel 30. The lower edge of the bar 40 in alignment with the ratchet wheel 30, is cut at an incline as indicated at 40a to form a tooth-like surface for insuring proper engagement with the teeth of said ratchet wheel 30. Due to the pivotal connection 39 of said actuating pawl 40 to the armature, said pawl is permitted lateral movement with respect to the armature.

In order to maintain said actuating pawl in proper position on the armature and for limiting its extent of lateral movement, we provide a guide in the form of a strap 42 extending over the actuating pawl adjacent the outer or free end of the armature. Said strap is secured to the armature by means of a pair of spaced apart studs indicated at 43.

It is to be understood that relay 32 is adapted to be intermittently energized by pulsations of electrical current which through the action of its armature imparts a step-by-step action to the pawl 40 and ratchet wheel 30 for shifting contact arms 22 and 23 in a step-by-step manner so that arm 22 is sequentially stepped over a series of contact buttons 16 corresponding to the number of electrical impulses imparted to the coil of the relay 32. It is to be understood that said pulsations of current may be supplied directly, or from a remote sending station, and in the latter case suitable receiving apparatus may be employed for use in transferring the wave impulses directly to the relay. Therefore, for convenience said relay 32 will hereinafter be termed a "stepping relay".

The actuating pawl 40 is dimensioned so that its extreme outer end projects into an opening 10a formed in the intermediate portion of the U-shaped mounting frame 10. Mounted on the outer face of said portion of the frame in registration with said opening, is an adjustable guide block 10b, having a slot or window formed therein for receiving the extreme end portion of the actuating pawl, as may be seen in Figure 3. It is to be understood that said block 10b is adapted to be adjusted with respect to the opening 10a for limiting the extent of vertical and lateral movement of the actuating pawl incident to the movement of the armature toward and away from the core of the relay 32. The purpose of providing for lateral movement of the actuating pawl is to permit said pawl to readily accommodate itself to the contour of the ratchet wheel during vertical movement of the pawl in stepping the ratchet wheel and thereby precludes binding of said pawl and the ratchet wheel which would otherwise occur due to the particular relationship of the pawl to the ratchet wheel.

To insure proper return of the actuating pawl to a starting position for engaging the next tooth of the ratchet wheel for obtaining successive stepping action, we provide a coil spring 46 which is connected at one end to the outer end of the pawl and at the other end to a stud 10c secured to the inside of the intermediate portion of the main frame 10, adjacent the upper end thereof, so that the spring is disposed at an oblique angle, tending to draw the actuating pawl in an upward and inward direction with respect to the ratchet wheel.

As above set forth, it is intended that the selector switch be constructed in a manner so that the portion of the circuit completed by engagement of contact arm 22 with a certain contact button 16, corresponding to the circuit selected, be maintained for only a short period of duration, after which the switch device is caused to be readjusted to a neutral or starting position. In order to accomplish this function, a check pawl 50 is pivotally mounted at 51 on the inside of the front or intermediate portion of the frame 10 adjacent the lower edge. Said pawl includes a sharp angularly formed nose 52 for engagement with the teeth of the ratchet wheel 30. The opposite end of the pawl terminates in an arm 53 to which is connected a coiled spring 54, the opposite end of which spring is connected to the lower portion of the adjacent leg of the frame 10, as seen in the drawings. The function of the spring 54 is to normally urge the pawl 50 in a direction to cause the nose portion 52 thereof to engage the teeth of the ratchet wheel 30 and to serve to check or hold the ratchet wheel in various stepped positions of adjustment, but permitting further step-by-step adjustment of said ratchet wheel, by the action of the actuating pawl 40.

Said check pawl 50 is normally held out of engagement with the ratchet wheel 30 by means of a "holding and reset relay" 56 which is mounted on the leg of the U-shaped frame 10 opposite to that upon which relay 32 is mounted. Said relay 56 is termed a "holding and reset relay" for convenience in description and because of the nature and function of said relay as will hereinafter be set forth. Relay 56 is disposed in opposite relation to relay 32 and has its armature 57 disposed at the lower end of the coil of the relay and hingedly connected at one end on a field piece 58. The armature 57 is normally

urged in a downward direction to the position seen in Figure 4 of the drawings by means of a coil spring 59 which is connected to the heel end of the armature and to an extension lug on the field piece 58. Connected to and extending inwardly from one end of the check pawl 50 is a relatively rigid rod 61 having an angularly bent offset portion positioned to engage beneath an insulating panel 62 secured to the lower surface of said armature 57.

It is to be understood that spring 59 of the armature 57 exerts a greater force than spring 54 of the check pawl so that the armature 57 is normally maintained, when the coil of the relay is deenergized, in the position seen in Figure 4 of the drawings, and due to the engagement with the rod 61 said armature holds the check pawl 50 out of engagement with ratchet wheel 30 as seen in Figure 2 of the drawings. As will hereinafter be described, relay 56 is energized during the period that relay 32 is being energized by pulsations of electrical current for imparting step-by-step action, through the pawl 40, to the ratchet wheel 30 and contact arms 22 and 23.

In order that the selector switch may be readjusted to a neutral or starting position after each adjustment for completing a preselected circuit, the ratchet wheel 30 is yieldingly urged in a counter-clockwise direction, or in other words, in a direction opposite to the direction of rotation caused by the stepping action of the pawl 40. For this purpose we provide a coil spring 65 which surrounds a portion of the bearing 28 within the frame 10 with one end of the spring extending through an aperture 10d in the intermediate portion of said frame and the opposite end of the spring anchored on a pin 30a carried on the adjacent face of the ratchet wheel.

It will now be apparent that as the ratchet wheel is stepped by the pawl 40, spring 65 becomes tensioned, so that upon release of the ratchet wheel by disengagement of the check pawl 50, said spring 65 tends to rotate the ratchet wheel in opposite direction to a starting or neutral position. The ratchet wheel is arrested at a normal or starting position which corresponds also to the starting position of the contact arm 22, as seen in Figure 5 of the drawings, by means of a nubbin 30b carried on said wheel and adapted to engage a projecting shelf portion 66 of a bracket 67 adjustably mounted on the inner surface of the intermediate portion of the U-shaped frame 10 so that when the nubbin engages said shelf portion, the ratchet wheel will be adjusted at a neutral or starting position with the contact arm 22 likewise disposed in a neutral or starting position.

Associated with the respective relays 32 and 56 are switch devices connected in electrical circuits in a manner for controlling the "make and break" of a preselected electrical circuit which as above mentioned may be one of a number of main electrical circuits or one of a number of branch electrical circuits forming a part of the main circuit, and which preselected circuit corresponds to the circuit completed through the corresponding contact buttons 16, when engaged by contact arm 22, due to the step-by-step actuation of the ratchet wheel, as above described.

It is to be understood that each of the different branch or main electrical circuits to be controlled, including the respective contact buttons 16, also include suitable mechanism adapted to be electrically energized or operated. For con-

venience in illustration, we have represented in the wiring diagram in Figure 6 of the drawings a plurality of branch circuit portions connected to the respective contact buttons 16, with each of said branch portions shown as including a winding or coil indicated generally at 70, which coil, it may be understood, may represent any suitable form of electrically energized device adapted to be operated when the particular branch circuit is completed through its corresponding contact button by contact arm 22.

The switch devices associated with the respective relays will now be described. Mounted on a bracket 72 attached to one of the legs of the U-shaped frame 10, immediately above the "stepping relay" 32, are two sets of switches composed of switch fingers 73, 74, and 75, 76 respectively. In the normal inoperative position of the selector switch, switch fingers 73 and 74 have their contact buttons 73a and 74a operatively engaged, while switch fingers 75 and 76 have their contact buttons 75a and 76a separated, as seen in Figure 3 of the drawings. Associated with the respective switch fingers 73, 74 and 75, are spring strips 78 for reenforcing said fingers and serving to increase the spring action thereof for urging them to return to a normal position.

Said switch fingers and strips are mounted between a multiplicity of blocks 79 of insulating material mounted directly upon said bracket 72. Connected to the outer end of switch finger 73 is a plug of insulating material 80 adapted to seat directly upon an arm 82 of a "clock type" mechanical timing mechanism which is indicated generally at 83. The outer end of switch arm 76 is also provided with a plug of insulating material 84, the lower end of which is adapted to be engaged by the end of switch finger 74, when the latter is moved to the position seen in Figure 3, by engagement therewith by switch fingers 73, incident to the upward movement of said switch finger through plug 80, by the arm 82 of the timer as will hereinafter be described.

The "hold and reset relay" 56 has associated therewith a normally open switch including contact fingers 85 and 86, the former being mounted on the insulating member 62 and the latter being mounted between blocks of insulating material indicated at 87 carried on an extension of the field piece 58, as seen in Figure 4 of the drawings. When the armature 57 is moved into engagement with the core 56a of said relay 56 contact finger 85 is thereby moved into operative engagement with contact finger 86 to complete a portion of an electrical circuit.

The mechanical timing mechanism designated at 83 is of a conventional form and is carried on a mounting plate 88 which is secured by screws 89 to the outer surface of the leg of the frame 10, upon which relay 32 is mounted. While the details of construction of the timing mechanism constitute no part of the present invention it is believed helpful to a better understanding of the entire operation of the selector switch to point out that the arm 82 of the timing mechanism is the main control member thereof, actuated in one direction by the armature 36 as will hereinafter be described. Mounted on said arm 70 is a pivoted pawl 90 which is urged by means of a spring 91 into engagement with the toothed periphery of a ratchet wheel 92 of the mechanism so that as said operating arm 82 is moved in a downward direction by armature 36, the pawl 90 cams over the teeth of the ratchet wheel,

but upon upward direction of movement of said arm said pawl tends to rotate the ratchet wheel 92, and the gearing associated therewith. A coiled spring 94 is connected at one end to said arm 82 and at the other end to said mounting plate 88 in a position for normally urging the arm 82 in an upward direction, under control of the gearing driven by the ratchet wheel 92.

As may be seen in the drawings, said operating arm 82 is normally disposed in a position immediately beneath and in engagement with the lower end of the plug 80, associated with switch finger 73. Said arm is adapted to be moved in a downward direction incident to the attraction of the armature 36 to the core 32a of the relay 32, and for this purpose the strap 42 for holding the actuating pawl 40 confined on the armature includes a forwardly extending leg 42a, positioned to extend immediately above said operating arm 82 so that when said armature is attracted to the core of the coil of the relay 32, said arm 82 is moved downwardly, and when said arm is freed of the pressure of the armature, through the leg extension 42a, said arm is drawn upwardly by the coiled spring 94 under control of the gearing of the timer mechanism.

It is to be understood that the gearing of the timer mechanism and the tension in the coil spring 94 are so correlated that when the arm 82 arrives at the position seen in Figure 2 of the drawings, the forces are substantially balanced. In other words, the position of the parts is then such that the arm 82 has imparted sufficient movement to plug 80 for shifting switch finger 73 into engagement with switch finger 74 and the latter through the plug 84 has moved switch finger 76 out of engagement with switch finger 75, as seen in Figure 3 of the drawings.

It will be apparent that during the period of pulsating action of the armature 36, due to the intermittent energizing of relay 32 by pulsations of current, the operating arm 82 of the timing mechanism is substantially held in a position out of engagement with the plug 80 so that switch fingers 73 and 74 are in open position, while switch fingers 75 and 76 are in engagement to complete portions of an electrical circuit.

This delay action of arm 82 as regards the switches composed of fingers 73, 74 and 75 and 76 is due to the gearing of the timing mechanism which requires an interval of time for return of the arm 82 to its uppermost normal position, substantially in excess of the time between pulsations of current imparted to the relay 32. Therefore, the arm 82 is permitted to move upwardly under timing control of the gearing when pulsations of current to the relay 32 cease, and effects a time delay action of the switches.

It will now be seen from the wiring diagram represented in Figure 6 that the switches composed of switch fingers 73 and 74 and 85 and 86, respectively, are connected in series in the main electrical circuit, while the switch composed of switch fingers 75 and 76 controls the supply of current to the "hold and reset relay" 56 from an auxiliary circuit which for convenience may be a low voltage circuit. If desired, the main electrical circuit could be connected as a part of the low voltage circuit but generally the main circuit is preferably of higher voltage for the proper operation of the devices to be actuated in the branch circuits of the main electrical circuit.

The circuits of the selector switch will now be briefly described as follows. The coils 70 are

shown connected in the branch circuits of the main supply circuit which includes conductors designated as lines #1 and #2. This circuit includes a main conductor wire 100 for connecting the current supply line #1 to the switch finger 73 and a conductor wire 101 connects switch finger 74 to switch finger 85, and a conductor 102 connects switch finger 86 to the conductor wire 20, which is connected to the contact strip 19, through contact arm 23 to the contact arm 22, to a predetermined contact button 16, corresponding to the preselected branch circuit to be energized. Conductor wires 17 complete the branch circuits through the respective coils 70 to the other main current supply line #2.

When the selector switch is in inoperative position no current is permitted to flow through the main circuit including conductor wires 100, 101, 102 and the supply lines #1 and #2 since the switch composed of members 85 and 86 is normally in open position. While pulsations of electrical current are imparted to the "stepping relay" 32 for effecting selective adjustment of the contact arm 22 with a desired contact button 16 by the action above described, the main circuit, due to operation of the switch fingers 73 and 74, remains open during the period that pulsating current is supplied to said relay 32.

As above mentioned, said switch fingers 73 and 74 become separated due to the attraction of the armature 36, through the leg extension 42a of the guide strip on said armature engaging the arm 82 of the mechanical timing device, so that said arm relieves the pressure on the lower end of the plug 80 and thereby permits switch finger 73 to yieldingly move out of engagement with its cooperating finger 74, and which, as also above mentioned, permits closing the switch composed of switch fingers 75 and 76, which results in energizing the "hold and reset" relay 56 which is connected in an auxiliary circuit including conductor wires 105, 106 and 107. Energizing of said relay 56 attracts armature 57 and moves switch finger 85 into engagement with finger 86 for completing a portion of the main circuit.

It will now be apparent that no current is permitted to flow through the main circuit including conductor wires 100, 101 and 102, and lines #1 and #2 during the period that the contact arm 22 is being stepped from one contact button to another.

Due to the fact that relay 56, as above mentioned, functions as a "hold and reset relay" and is energized during the time that pulsations of current are being supplied to the "stepping relay" 32, the check pawl 50 is freed by the armature 57, which is attracted to the core 56a of the coil of the relay 56, and thereby disengages the rod 61 so that the pawl 50 under influence of spring 54 operatively engages the teeth of the ratchet wheel 30 and maintains the same in stepped positions of adjustment.

Immediately upon cessation of pulsations of current being supplied to the relay 32, the armature 36 is released and moves to its upper free position by coil spring 37, and such movement of the armature through the leg extension 42a frees the operating arm 82 of the mechanical timing device 83 so that said arm 82 in a time delay action, after lapse of an interval of time, again forcibly engages the lower end of plug 80 and moves switch finger 73 into engagement with switch finger 74, thereby completing the preselected electrical circuit, including the main electrical circuit, for a predetermined timed in-

terval which timed interval is determined by the mechanical timer 83. As said arm 82 continues to move upwardly, after completion of a preselected circuit through the switch fingers 73 and 74, motion is transmitted through switch finger 74 and plug 84 for moving the switch finger 76 out of engagement with switch finger 75, and when this takes place the auxiliary circuit for supplying current to the "hold and reset relay" 56 is broken, whereupon the armature 57 of relay 56 is freed and moves away from the core 56a of the relay 56, simultaneously moving switch finger 85 out of engagement with switch finger 86, and thereby breaking the preselected circuit, and which action determines the timed interval during which said preselected circuit remains energized.

When the armature 57 moves away from the core of the coil of the relay 56, the insulating member 62 reengages the arm 61, associated with the check pawl 50, and thereby shifts said pawl out of engagement with the ratchet wheel 30, whereupon the spring 65 then returns the ratchet wheel together with the contact arms 22 and 23 to normal or neutral starting position.

The construction represented in the drawings may be understood to be especially suitable for use with alternating current, and for this purpose the "stepping relay" 32 is provided at its head with a copper slug 32c, the function of which is to act as a shading ring for eliminating chatter and buzzing. It is to be understood, however, that when this selector switch is intended for use with direct current, the "stepping relay" 32 shall be of modified form having proper characteristics for use with direct current.

It will now be apparent that by virtue of the construction described there will be no arcing as a result of the contact arm 22 moving from one contact button to another during the stepping action since no current flows through the main electrical circuit, including the branch circuits, until the selector arm is arrested for a short interval of time in engagement with a predetermined contact button of a preselected circuit, after which period of time current is permitted to flow through said preselected circuit for a limited period of time, under control of a mechanical timing device, and after which all circuits are then broken and assume a normal inoperative condition.

Although we have herein shown and described a preferred embodiment of our invention, manifestly it is capable of modification and rearrangement of parts without departing from the spirit and scope thereof. We do not, therefore, wish to be understood as limiting this invention to the precise form herein illustrated and described, except as it may be so limited in the appended claims.

We claim as our invention:

1. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, means for shifting said arm into engagement with a predetermined one of said contacts for completing a portion of a preselected branch circuit, switch means for controlling said main electrical circuit, and mechanical timing means for controlling said switch means, said timing means and first mentioned means being interconnected to effect energization of said timing means upon operation of said first mentioned means, and said timing means being rendered operable upon discontinuance of operation of said

first mentioned means, whereby said switch means is controlled to effect energization of the preselected branch circuit in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

2. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, means for shifting said arm into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches connected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit for controlling said normally open series switch, and mechanical timing means for controlling the other two switches in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, said timing means being responsive to and operated by said first mentioned means, whereby said switches are controlled in a manner to effect energization of the preselected branch circuit for a predetermined limited time, in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

3. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, electrical impulse operated electro-magnetic means for shifting said arm in step-by-step fashion into engagement with a predetermined contact for completing a portion of a preselected branch circuit, switch means for controlling said main electrical circuit, and mechanical timing means for controlling said switch means, said timing means being responsive to and rendered operable by said electro-magnetic means, whereby said switch means is controlled to effect energization of the preselected branch circuit in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

4. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, electrical impulse operated electro-magnetic means for shifting said arm in step-by-step fashion into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches connected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit for controlling said normally open series switch, and mechanical timing means for controlling the other two switches in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, said timing means being responsive to and operated by said first mentioned means, whereby said switches are controlled in a manner to effect energization of the preselected branch circuit for a predetermined limited time, in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

5. In a selector switch, the combination of a plurality of contacts connected in separate

branches of a main electrical circuit, a movable contact arm, means for shifting said arm into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches connected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit and arranged for controlling said normally open series switch, the other two switches being interconnected for correlated actuation, and mechanical timing means for controlling said other two switches, in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, said timing means being responsive to and operated by said first mentioned means, whereby said switches are caused to be actuated in a manner for effecting energization of the preselected branch circuit for a predetermined limited time, in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

6. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, electrical impulse operated electro-magnetic means for shifting said arm in step-by-step fashion into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches connected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit and arranged for controlling said normally open series switch, the other two switches being interconnected for correlated actuation, and mechanical timing means for controlling said other two switches in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, said timing means being responsive to and operated by said impulse operated electro-magnetic means, whereby said switches are caused to be actuated in a manner for effecting energization of the preselected branch circuit for a predetermined limited time, in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

7. In a selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, electrical impulse operated electro-magnetic means for shifting said arm in step-by-step fashion into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches con-

nected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit and arranged for controlling said normally open switch of said pair of switches, the other two switches being interconnected for correlated actuation, and mechanical timing means responsive to and operated by said impulse operated electro-magnetic means, said timing means being positioned for controlling said other two switches in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, whereby said timing means is caused to be energized during actuation of the impulse operated electro-magnetic means and rendered operative after cessation of operation of said impulse operated electro-magnetic means to effect energization of the preselected branch circuit for a predetermined limited time, in delayed timed relation, subsequent to engagement of said arm with the contact of the preselected branch circuit.

8. In a unitary self-contained selector switch, the combination of a plurality of contacts connected in separate branches of a main electrical circuit, a movable contact arm, electrical impulse operated electro-magnetic means for shifting said arm in step-by-step fashion into engagement with a predetermined contact for completing a portion of a preselected branch circuit, a pair of switches connected in series in the main circuit, one of said switches being normally open and the other normally closed, a separate normally open switch connected in an auxiliary circuit, an electro-magnet in said auxiliary circuit and arranged for controlling said normally open switch of said pair of switches, the other two switches being interconnected for correlated actuation, and clockwork type mechanical timing means having an arm positioned to be engaged by the armature of said impulse operated electro-magnetic means, said arm of the timing means being so positioned to control operation of said other two switches in such correlation to each other as to cause the auxiliary switch and electro-magnet of the auxiliary circuit to be controlled during an overlapping interval of the two series switches, whereby said mechanical timing means is caused to be energized during actuation of the impulse operated electro-magnetic means and rendered operative after cessation of operation of said impulse operated electro-magnetic means to effect energization of the preselected branch circuit for a predetermined limited time, in delayed time relation, subsequent to engagement of said contact arm with the contact of the preselected branch circuit.

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