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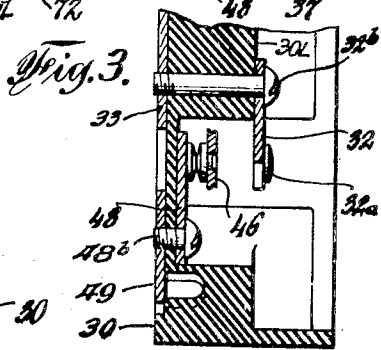
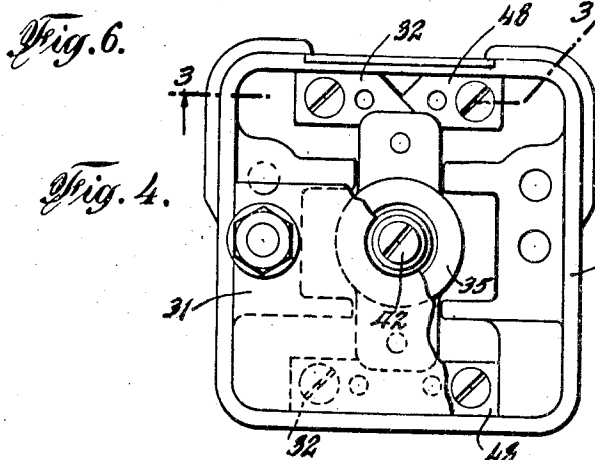
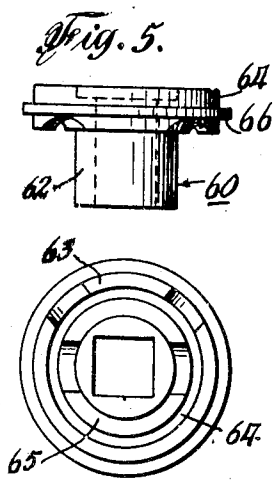
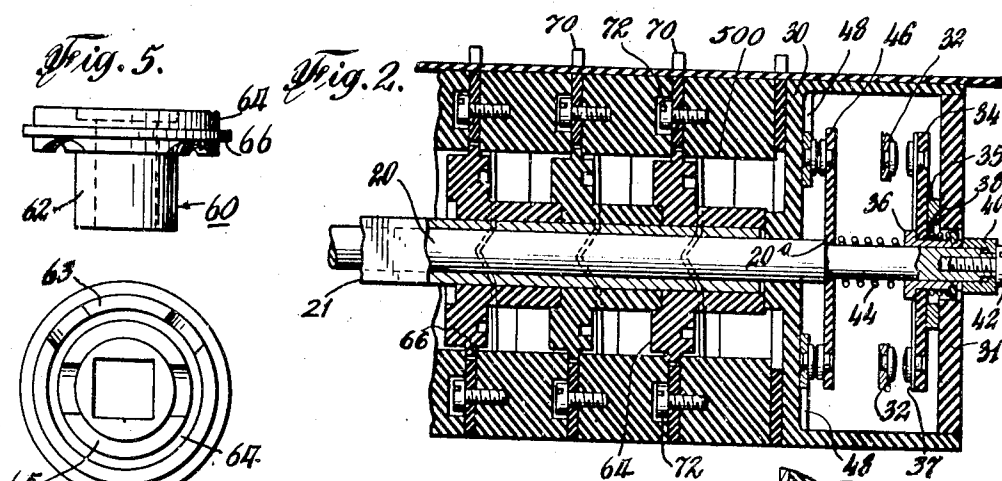
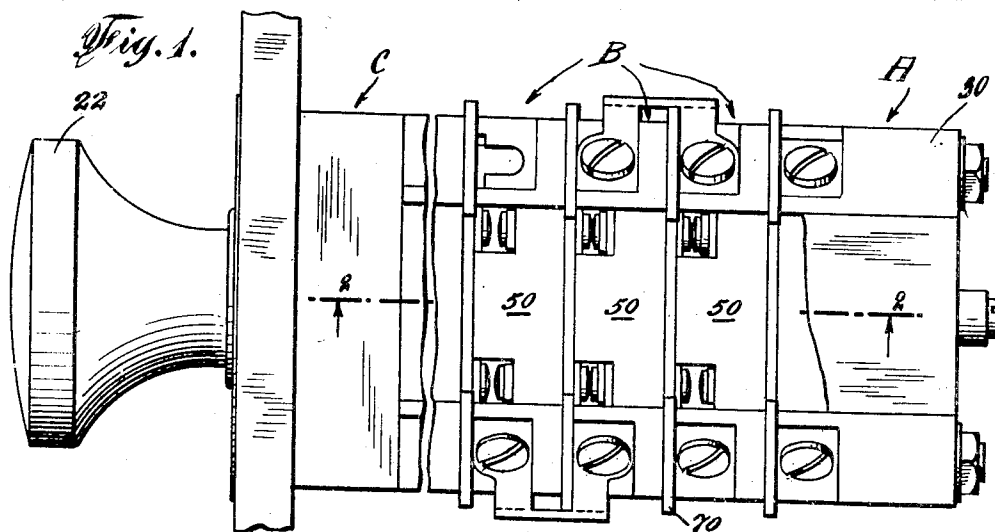
D. W. JOHNSON

2,451,224

PUSH PULL SELECTOR SWITCH

Filed Feb. 5, 1945

3 Sheets-Sheet 1



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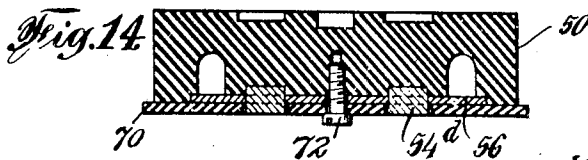
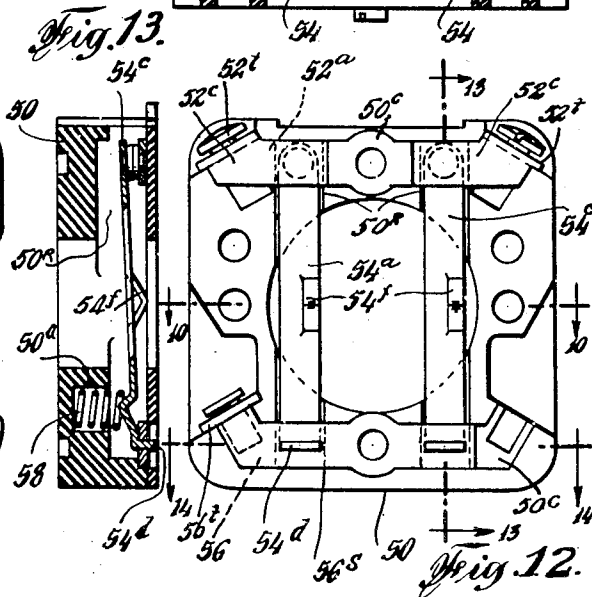
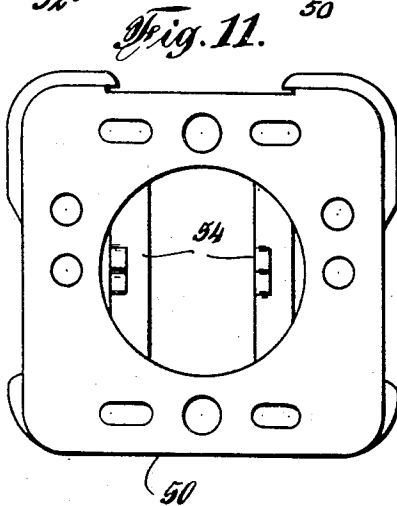
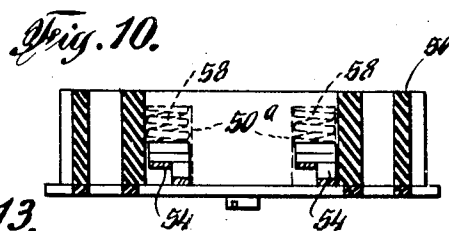
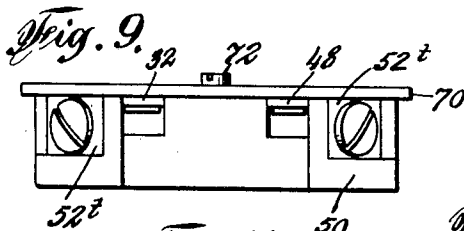
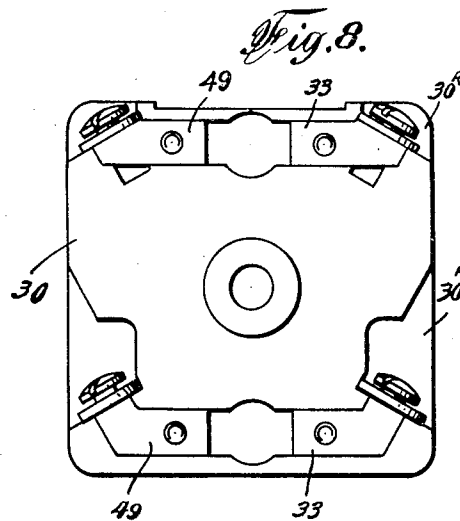
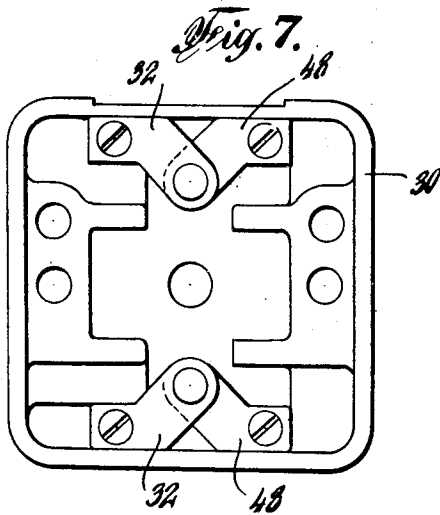
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PUSH PULL SELECTOR SWITCH

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3 Sheets-Sheet 2



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Oct. 12, 1948.

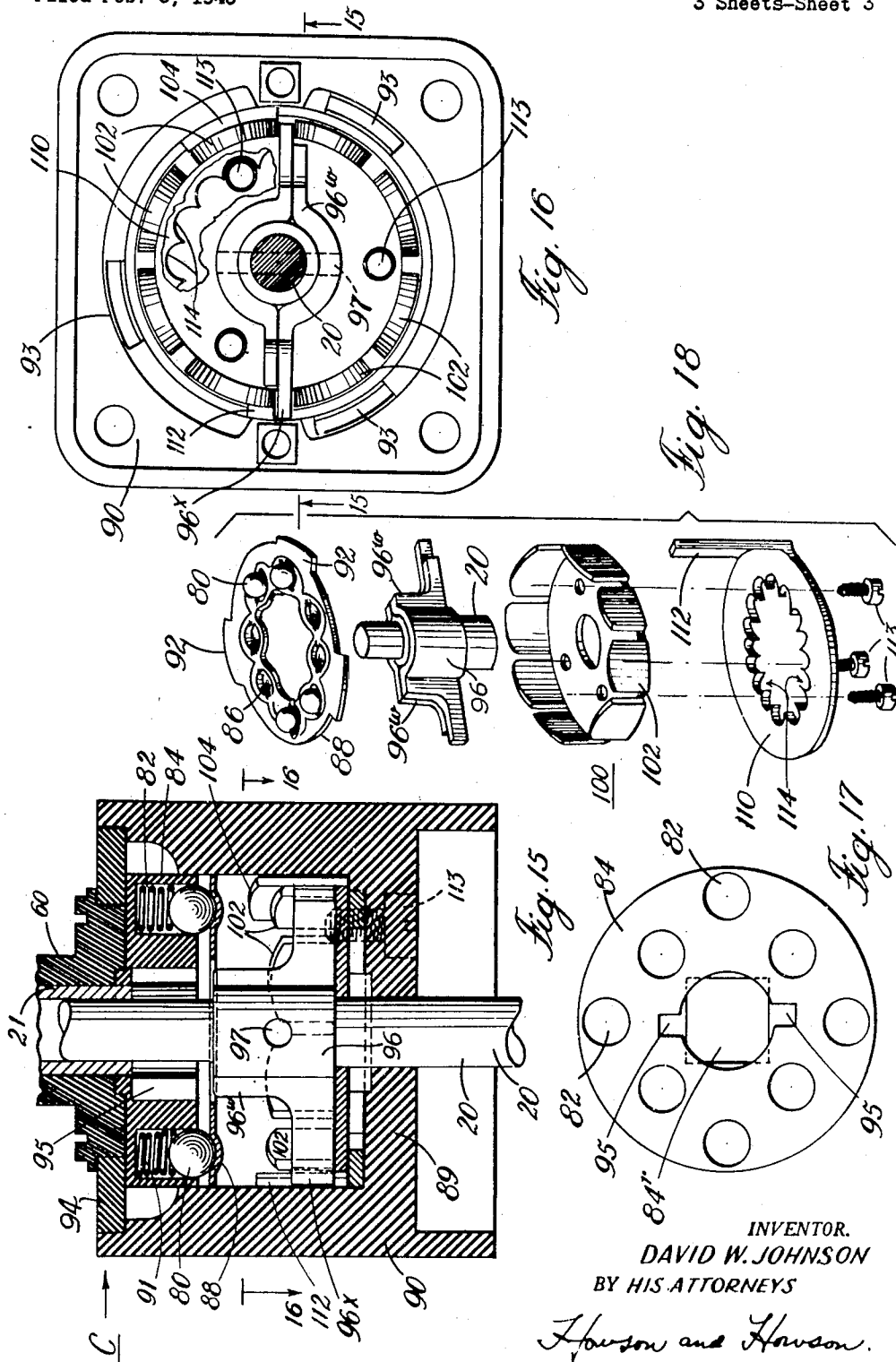
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PUSH PULL SELECTOR SWITCH

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,451,224

PUSH-PULL SELECTOR SWITCH

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Application February 5, 1945, Serial No. 576,270

29 Claims. (Cl. 200—4)

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This invention relates to selector switches of a type that is rotatable manually to select a desired set of contacts for controlling the desired circuit and which may be pushed or pulled to open or to vary the power line arrangements.

The invention further relates to provision in this type of selector switch wherein the selection can take place only after the power circuit contacts have been moved to open circuit position.

In the control of automatic machines such as two-speed reversible lathes, automatic Bakelite presses, cylindrical grinders and many other machines wherein certain operations must from time to time be selected and performed without first performing other operations in sequence, it is necessary in present practice to use a considerable number of electromagnetic switches and push buttons in complicated interlocking circuit arrangements. As a result, the expense of the control arrangement for such machines is high.

Furthermore, unless signal lights are used (which are not common) it is ordinarily impossible to accurately tell which circuit arrangement has been established by the last manual operation of a push button. This is true because the push buttons ordinarily have return springs and when released, leave no indication of previous operation.

It is an object of this invention to provide an improved switch structure of the type wherein selection of any desired circuits, without the need of energizing in sequence a set pattern of such circuits, may be made by rotation while power circuits are disconnected, such disconnection and freeing the switch spindle for rotation being accomplished by axial motion of the spindle.

Another object is to provide an integrated indexing and unlocking means in a selector switch of the foregoing type.

Another object is to provide a rotary selector switch wherein rotation of the manual operating elements will cause selection of desired control circuits and pushing or pulling of the control element vary the power line connections to either open the power line circuit or change from one type of power feed to another.

Another object of the invention is to provide, in a push pull selector switch of the above mentioned type, an improved structure which may be economically manufactured and will be of rugged construction suitable for industrial use and in which the control elements may be varied in the course of manufacture to satisfy the requirements to use on different types of machines whose control circuits are essentially different.

Other objects and advantages of my invention

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will become apparent as the invention is described in connection with the accompanying drawing.

In the drawings—

Fig. 1 is a side elevation view of the invention.

Fig. 2 is a longitudinal section view taken along line 2—2 of Fig. 1;

Fig. 3 is a fragmentary longitudinal section view taken along line 3—3 of Fig. 4;

Fig. 4 is a back end view of the invention, partly broken away;

Figs. 5 and 6 are side and end elevation views of the typical cam which operates the control contacts in the invention;

Fig. 7 is an end view of the back section of the invention with the movable parts removed;

Fig. 8 is a front end view of the back end section shown in Fig. 7;

Fig. 9 is a side elevation view of one of the control sections of the invention;

Fig. 10 is a section view taken along line 10—10 of Fig. 12;

Fig. 11 is a plan view of the back face of the section illustrated in Fig. 9;

Fig. 12 is a plan view of the front face of the section illustrated in Fig. 9;

Fig. 13 is a section view taken along line 13—13 of Fig. 12;

Fig. 14 is a section view taken along line 14—14 of Fig. 12;

Fig. 15 is a longitudinal section view of the interlocking and indexing section and part of adjacent control section;

Fig. 16 is a plan view looking into the housing of the interlocking and indexing section with the ball retainer and associated parts removed;

Fig. 17 is a detail view of the indexing ball retainer;

Fig. 18 is an exploded perspective view of certain parts from the indexing and interlocking section C of the device.

Referring to the drawings the switch is built in sections such as A, B and C, from molded insulating base members which carry various conductive or functional parts. Operation of the device is by rotation of a shaft 20 which passes through all the sections and carries a handle 22 at one end.

Section A may contain fixed and movable contacts to open and close connections to power lines.

Sections B may contain wire terminals, fixed and movable contact elements and the cams for operating the contacts to establish connections in control circuits of machines and electrical apparatus of any sort.

Section C may contain parts for holding the movable elements and switch shaft in the various

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positions into which they may be moved, and releasably locking them therein.

The functions of, and the elements in, the several sections are interrelated and coordinated (a) to allow operation of the control circuit contacts in Sections B only when the power line connections are open i. e. when all control circuits are "dead"; and (b) to allow change from 2 to 3 line power supply while control circuits remain established but retaining the provision against varying the control circuit contact relationship while the control circuits are "alive" and (c) to allow selection freely of any control circuit condition without, in the process of such selection, following a sequence or energizing unwanted intermediate control circuits.

I

Section A comprises an insulating body or base member 30, hollowed out to provide ledges 30L on which a pair of fixed contact members 32 can be mounted on opposite sides of the base. Bolts 32b passing through the ledge and casing may secure the contacts 32 thereon and may connect the contacts 32 to wire terminal members 33 on the opposite side of the base wall. Terminal members 33 may have portions bent to lie in recesses 30R on the outside of base 30 with conventional terminal screws easily accessible therein.

The contact members 32 may be stamped from sheet metal with contact buttons 32a affixed to one end in position to be engaged by like buttons on a non-conductive bridging member 34. Member 34 is mounted slidably on a sleeve 36 near what may be considered the bottom end of operating shaft 20. Flanges or their equivalent hold the member 34 on sleeve 36 and a compression spring 38 coiled around the sleeve presses the contact 34 against the innermost sleeve flange, normally. The contact buttons on member 34 may be electrically connected by a thin strip 37 of conductive metal not touching sleeve 36.

To cause movement of the sleeve and contact 34 with the shaft 20 when the shaft is pulled, a cup member 40 is held on the end of the shaft 20 by a screw bolt 42 threaded into the end of the shaft. The end of said cup abuts the end of said sleeve during said pulling action. Movement of the sleeve and the member 34 carried thereby will cause the contact buttons thereon to engage the fixed contacts 32, resiliently because of spring 38.

To hold the contact buttons of member 34 normally disengaged from their complementary fixed contacts a compression spring 44 is coiled around the shaft 20 above the member 34 and presses sleeve 36 and member 34 toward the bottom end of shaft 20. The upper end of spring 44 presses upon a stamped sheet metal bridging contact bar 46 slidably mounted on the shaft 20 and urges bar 46 toward a shoulder 20a on the shaft 20. Conventional contact buttons on the ends of bridge bar 46 are engageable with similar buttons on fixed contact members 48. Screws 49b passing through the inner end wall of the base member 30 secure the contact members 48 against said wall and connect members 48 to separate wire terminal members 49 seated in a channel in the opposite side of said wall. Terminal members 49 may have portions bent to lie in recesses in the outside of base 30 and may have easily accessible terminal screws threaded therein.

Spring 44 thus functions to hold contact 46 in position to bridge contacts 48 normally and to

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hold member 34 against the insulating spacing washer 35, out of engagement with contacts 32. A back plate 31 secured in any suitable fashion to base 30 supports the spacing washer 35. Thus when the shaft is pushed (toward the right in Fig. 2) contact 34 remains stationary, spring 44 is compressed and shoulder 20a moves contact 46 from engagement with contacts 48.

When shaft 20 is released spring 44 returns the parts to the position shown in Fig. 2.

When shaft 30 is pulled to the left in Fig. 2 contact 46 remains stationary in bridging position and bridging contact 34 is moved into bridging engagement with stationary contacts 32.

II

Each of the sections B, embracing the contacts and mechanism for establishing control circuits for machines, apparatus or any sort of arrangement involving electric control circuits, comprise a substantially square body section 50 of molded insulation with flat top and bottom faces. The body 50 is centrally apertured as at 500 to permit passage of the shaft 20 and to accommodate an operating cam member 60 that is made of molded insulating material and slidably mounted on shaft 20.

In the front face of body 50 and adjacent opposite sides thereof, substantially parallel channels 50c are formed.

In opposite ends of one of said channels are seated stamped sheet metal terminal and contact members 52a, 52c each having a terminal portion 52t bent at right angles to its contact portion to lie in a recess in the outer surface and be accessible from outside of the body. The channels 50c are interrupted by transverse recesses or passageways 50r deeper than channels 50c, for the purpose of receiving the end portions and permitting the movement of one end of a pair of flexible contact strips 54a, 54c. The moving end of strips 54a, 54c has a contact button to engage a like contact button on the contact members 52a, 52c. The fixed end of strips 54a, 54c are pivotally anchored in a terminal bar 56 stamped from sheet metal and lying in the lower channel (Fig. 2). A terminal tend 56t is bent at right angles thereto so as to lie in a recess in the outer surface of the body 50 and be accessible from the outside. For pivotal anchoring of the strips 54a, 54c spaced slots 56s are provided in terminal bar 56 over the recesses 50r to receive bent end portions 54d.

To constantly urge the movable contact strips into engagement with the fixed contacts a compression spring 58 is seated in a well 50a provided therefor in the body 50 near the pivoted end of each of the strips 54a, 54c.

To operate the contacts 54a, 54c a rotary molded insulation cam member 60 is centrally apertured and slidably mounted on a square sectioned sleeve 21 on the central portion of the shaft 20. The shaft 20 is circular in section and is slidable within the sleeve 21, but the sleeve and shaft turn together, by means hereinafter described.

Cam 60 comprises a hub portion 62 and a cylindrical head portion 64 having a peripheral flange 66 thereon. Rotary movement of the cam is guided by the periphery of the cam moving within the central opening 500 in the body 50. Axial motion of the cam on the shaft is prevented by the peripheral flange 66 which slides between opposed surfaces of adjacent bodies 50 of neighboring sections B (Fig. 2), which are

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spaced apart by an insulating plate 70. Plate 70 has a circular central aperture within which flange 66 rotates, and plate 70 is secured by screw bolts 72 upon the surface of body 60 to hold the contact and terminal members 52a, 52c, and 56 seated in channels 50c.

Movement of the contact strips 54a, 54c is caused by concentric cam surfaces or tracks 63, 65 on the head of the cam 60 engaging with cam following portions such as 54f lanced out of the movable contact strips.

All sections B may be alike; or some may have fixed contact members 52a, 52c made unitary; and terminal bar 56 may be made in two insulated parts; or other combinations of such parts may be made so that when circuit connecting wires are attached to the terminals 52t and the cam operator is rotated any desired connections may be established in the associated control circuits.

III

All parts of the indexing and interlocking section C of the device are housed within a hollow insulating shell casing 90 of generally square form.

To locate the shaft 20 in any of the several positions into which it may be turned the indexing section C has two or more spring pressed balls 80 located in concentrically arranged wells 82 in an insulating disc or ball retainer 84 which rotates with shaft 20. The balls 80 cooperate with concentrically arranged indentations 86 in a stationary metal indexing plate 88. Plate 88 may be held from rotating by one or more radial extensions 92 fitting into complementary shallow radial recesses 93 against whose bottoms said extensions press by reason of the urge of the spring 91 behind the balls 80.

Ball retainer 84 rotates in a fixed plane being guided on its upper face (as viewed in Fig. 15) by a bearing annulus 94 of insulating material which is countersunk in the inner face of the housing 90 (said inner face being the upper face in Fig. 15) and held there by screws or in any suitable fashion. The lower peripheral edges (as viewed in Fig. 15) of the retainer 84 are rotatively guided by the walls of the central circular bore in shell 90 within which the retainer 84 rotates.

The operating shaft 20 is axially slidable through the ball retainer but is keyed to it so as to cause its rotation with the shaft. For such purpose offset radial slots 95 are provided in the ball retainer to receive offset radially extending wings 96w of a fabricated key member 96 affixed to the shaft 20 by a pin 97.

In the bottom of the ball retainer 84 is a square recess 84r receiving the end of sleeve 21, so that rotation of the ball retainer and shaft 20 is accompanied by rotation of sleeve 21 and cams 60 thereon.

To prevent turning of shaft 20 from an operating to an "off" position, except when it is pushed (up in Fig. 15) to open contacts 46, 48 in section A, a lock member 100 is seated in the housing 90. The lock member may comprise a plate stamped from sheet metal with a series of arcuate concentrically located fingers 102 bent to extend parallel to the axis of shaft 20. One or both of wings 96w are provided with an extension 96x to fit in the slots between fingers 102 in the different angular positions of the shaft 20 and, when so engaged, to lock the shaft against rotation. The locking engagement is maintained in the neutral axial position of the shaft and also when the shaft is pulled axially to close con-

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tacts 32, 34 in section A. (The contact-carrying bar or member 34 and shaft 20 are in neutral position in Fig. 2; but in Fig. 15 the shaft and key member 96 have been pulled to the position there shown.) Unlocking can be accomplished by pushing the shaft (to right in Figs. 1 and 2, or up in Fig. 15) from neutral which will withdraw the extension 96x from engagement with the locking plate fingers 102. At the same time this movement of the shaft maintains the engagement of the wings 96w with the indexing ball retainer 84, which prevails in neutral position (though not in the pulled position of Fig. 15).

During rotation, to select a new switch position, contacts 32, 34 and 46, 48 will be in open-circuit position. Such rotation will cause rotation of cam members 60 in section B and corresponding operation of the movable control contacts 54 to establish a new condition in the control circuits. The handle may have an arrow, pointer or other indicator which by its position, will show the nature of the circuit established. On release of the handle, spring 44 will return the shaft 20 to neutral or normal axial position to again interlock the wing extension 96x with the lock member 100 to prevent rotation from the selected position.

To limit the rotation of the shaft to a predetermined arc or number of positions, a rib 104 is provided on the interior wall of the central well of base 90, being molded integrally with base, preferably.

If both wings 96w are provided with extensions such as 96x, the rotation of the shaft 20 will be limited to less than 180° because one or the other of the extensions will engage the rib 104 before 180° rotation can be completed. If one wing only is extended the permissible arc of rotation will be doubled.

To provide additional and adjustable limitation on the permissible arc of rotation, a stamped sheet metal stop-plate 110 comprising an apertured disc with a stop finger 112 upstanding from its periphery, is seated between the lock member 100 and the radial partition wall 39 of the body 90. The inner periphery of the stop-plate has a series of semicircular indentations or recesses 114 arranged in circular pattern to receive the shanks of one or more of the securing screws 113 which are provided to hold the locking member 100 to the body 90. In assembling the device, the stop-plate 110 is placed with the stop finger 112 in such angular position with relation to the stop rib 104 as to allow the shaft 20 the desired angle of rotation, and to limit it thereto by reason of the wing extension 96x engaging the stop rib 104 and stop finger 112. When located in the predetermined position the stop-plate 110 is held against rotation by the interengagement of screws 113 with recesses 114.

From the foregoing it will be apparent that the invention provides a simple solution to the need for a selector switch which can be manually operated and will not only give positive indication by its position of the selected circuit, but may not be operated to or from such position while the power line circuits are closed. The invention also allows the operator to select a certain operation of the machine without the need of making the machine go through a sequence of other operations to reach the desired operation.

Although in the embodiment illustrated it is necessary to push the operating handle in order to rotate the switch and select the desired con-

trol circuit, it will be obvious to those skilled in the art that this arrangement could readily be reversed so that a pull would be necessary to disconnect the power line circuits and permit rotation and selection.

From the foregoing it will also be apparent that, because of the many functions it is possible to accomplish by rotation of the single manual control element into a plurality of positions for selection a plurality of circuits, the number of electromagnetic switches needed is materially reduced and the need for a plurality of manually operable elements such as push buttons for controlling the many operations of automatic machines is also materially reduced with attendant reduction in the space requirements and uncertainty as to the circuit established by the previous operation.

Many modifications and variations of the invention will occur to those skilled in the art. Therefore, I do not limit the invention to the specific embodiment shown.

I claim:

1. In a push-pull selector switch, a base, operating means movable axially and rotatably, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement of said operating means, contact means operated by rotary movement of said operating means, self-acting means acting normally to move said operating means into one axial position from which said operating means may be moved into at least two other axial positions, a plurality of contact means operable by movement of said operating means into certain of said axial positions.

2. A push-pull switch, an axially movable shaft, a key member affixed to said shaft, a locking member engageable and disengageable by said key member by axial movement of the shaft, movable contact operating means rotatable by said shaft, movable contact operating means operable on axial movement of said shaft, means normally holding said shaft in a mid-position from which it can be manually moved axially forwardly and rearwardly.

3. In a push-pull switch, a base formed of a plurality of stacked insulating sections, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and one of said base sections and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means located in other of said base sections and operated by rotary movement of said operating means, plural contact means operated by movement of said operating means into and from certain axial positions, stop means adjustably positionable within said first section and cooperating with said interlocking means to limit the arc of rotary movement of said operating means.

4. In a push-pull switch, a base, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means operated by rotary movement of said operating means, plural contact means operated by movement of said operating means into and from cer-

tain axial positions, stop means on said base, and a stop plate adjustably positionable relatively to said stop means and cooperating with said interlocking means to limit the rotary movement of said operating means to a predetermined arc.

5. In a push-pull switch, a base formed of a plurality of stacked insulating sections, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and one of said base sections and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, said interlocking means comprising a key member movable with said operating means, a lock plate within said base and having a plurality of slots to receive said key member in different rotary positions thereof, in combination with plural contact means located in other of said base sections and operated by rotary movement of said operating means, and contact means loosely mounted on and operated by movement of said operating means into and from certain axial positions.

6. In a push-pull switch, a base formed of a plurality of stacked insulating sections, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and one of said base sections and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, said interlocking means comprising a key member movable with said operating means, a lock plate within said base and having a plurality of slots to receive said key member in different rotary positions thereof, in combination with plural contact means located in other of said base sections and operated by rotary movement of said operating means, and contact means loosely mounted on and operated by movement of said operating means into and from certain axial positions, stop means adjustably positionable within said first section and cooperating with said interlocking means to limit the arc of rotary movement of said operating means.

7. In a push-pull switch, a base, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, said interlocking means comprising a key member movable with said operating means, a lock plate within said base and having a plurality of slots to receive said key member in different rotary positions thereof, in combination with stop means on said base, and a stop plate adjustably positionable relatively to said stop means and cooperating with said interlocking means to limit the rotary movement of said operating means to a predetermined arc, plural contact means operated by rotary movement of said operating means, contact means operated by movement of said operating means into and from certain axial positions.

8. In a push-pull switch, a base, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means operated by rotary movement of said operating means, plural contact means movable axially

with said operating means, one of said axially movable contact means moving and the other remaining stationary when the operating means moves in one direction.

9. In a push-pull switch, a base, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means operated by rotary movement of said operating means, plural contact means movable axially with said operating means, one of said axially movable contact means moving and the other remaining stationary when the operating means moves in one direction, said other of said axially movable contact means moving and said one contact means remaining stationary when the operating means moves in the other direction.

10. In a push-pull switch, a base, operating means movable into a plurality of rotary and axial positions, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means operated by rotary movement of said operating means, fixed contact means, plural bridging contact means movably mounted on said operating means and engageable with said fixed contact means when said operating means is moved into one axial position and disengaged from said fixed contact means when moved into a second axial position, in a third axial position one of said bridging contact means being engaged with said fixed contact means.

11. In a push-pull switch, a base formed of a plurality of stacked insulating sections operating means movable into a plurality of rotary and axial positions, means associated with said operating means and one of said base sections and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, contact means located in other of said base sections and operated by movement of said operating means into and from certain axial positions to make and break power line connections, and plural contact means operated by rotary movement of said operating means comprising a plurality of individual cam members rotating with said operating means but slidable relatively thereto and located in different sections of said base, movable contact members operated by said cam members for engaging and disengaging fixed contact members to select and establish circuit arrangements.

12. In a push-pull switch, an interlocking section, a selector section and a control section, operating means movable into a plurality of rotary and axial positions, said interlocking section comprising a base, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, and said control section comprising contact means operated by movement of said operating means into and from certain axial positions to make and break power line connections, and said selector sections each comprising individual base members, fixed and movable contact members, and cam members rotating with said operating means but slidable relatively thereto to operate said movable contacts on rotation of

said cam members to select and establish different circuits.

13. In a push-pull switch, an interlocking section, a selector section and a control section, operating means movable into a plurality of rotary and axial positions, said interlocking section comprising a base, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, and said control section comprising contact means operated by movement of said operating means into and from certain axial positions to make and break power line connections, and said selector sections each comprising individual base members, fixed and movable contact members, and cam members rotating with said operating means but slidable relatively thereto to operate said movable contacts on rotation of said cam members to select and establish different circuits, said interlocking, control and selector sections having cooperating base structures to permit desired variation in the number of sections incorporated.

14. In a push-pull switch, a base comprising interfitting insulating sections, operating means movable into a plurality of rotary and axial positions, means located in one section and associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means located in other and separate base sections and operated by rotary movement of said operating means, plural contact means located in a separate base section and operated by movement of said operating means into and from certain axial positions, spring means holding certain of said axially operable contact means in self-adjusting engagement and concomitantly holding said interlocking means in an active position.

15. In a push-pull switch, a base comprising interfitting insulating sections, operating means movable into a plurality of rotary and axial positions, means located in one section and associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, plural contact means located in other and separate base sections and operated by rotary movement of said operating means, plural contact means located in a separate base section and operated by movement of said operating means into and from certain axial positions, spring means cooperating with certain of said axially operable contact means to hold the latter in a predetermined position and concomitantly holding said interlocking means in an active position.

16. In a push-pull switch, an interlocking section, a selector section and a control section, operating means movable into a plurality of rotary and axial positions, said interlocking section comprising a base, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, and said control section comprising contact means operated by movement of said operating means into and from certain axial positions to make and break power line connections, and said selector sections each comprising individual base members, fixed and movable contact members, and cam members rotating with said operating means but slidable relatively there-

to to operate said movable contacts on rotation of said cam members to select and establish different circuits, said cam members having camming surfaces facing in a direction parallel to the axis of rotation and at different radial distances from said axis, the movable contacts in said selector sections extending over said camming surfaces and having cam engaging portions.

17. In an electric switch having a shaft movable axially and rotatably to operate different sets of contact means on rotation and on axial motion, means to hold said shaft resiliently in certain positions comprising a relatively movable ball retaining means and indexing plate means, spring pressed balls cooperating with said retaining means and plate means in combination with interlocking means a part of which turns with said shaft and is engaged with said indexing means in certain axial positions to actuate said indexing means on rotation of the shaft.

18. In an electric switch having a shaft movable axially and rotatably to operate different sets of contact means on rotation and on axial motion, means to hold said shaft resiliently in certain positions comprising a relatively movable ball retaining means and indexing plate means, spring pressed balls cooperating with said retaining means and plate means in combination with interlocking means engaged with said indexing means in certain axial positions to actuate said indexing means, means preventing rotation of said shaft but ineffective in a certain axial position of said shaft, said interlocking means engaging said indexing means when said interlocking means is ineffective, to cause rotation of said indexing means with said interlocking means.

19. In an electric switch having a shaft movable axially and rotatably to operate different sets of contact means on rotation and on axial motion, means to hold said shaft resiliently in certain positions comprising a relatively movable ball retaining means and indexing plate means, spring pressed balls cooperating with said retaining means and plate means in combination with interlocking means engaged with said indexing means in certain axial positions to actuate said indexing means and a housing for said indexing and interlocking means through which said shaft extends, said housing having stop means engageable by said interlocking means to limit the arc of rotation of said shaft.

20. An electric switch as claimed in claim 19 wherein the stop means is integral with the housing, and there is an adjustably positionable stop plate, said interlocking means engaging with said plate and said stop means to limit the arc of rotation of said shaft.

21. In a push-pull selector switch, a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, means to maintain said shaft normally in an intermediate position from which it may be moved axially forward or backward, selector contact means operable by rotation of said shaft, line control contact means operable by axial motion of said shaft, locking means movable with said shaft holding said shaft against rotation when said line control contact means is engaged and released when said line control contact means is disengaged.

22. In a push-pull selector switch, a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, selector contact means operable by rotation of said shaft, line control contact means operable

by axial motion of said shaft, indexing means for said shaft, means to lock said shaft against rotation in certain axial positions thereof, a portion of said locking means interengaging with said indexing means to cause rotation of the latter when said shaft rotates.

23. In a push-pull selector switch, a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, selector contact means, interengaging insulating base sections, means within at least one of said sections and slidably mounted on and rotating with said shaft for operating said selector contact means, in combination with cooperating fixed and movable contact means, said movable contact means being resiliently mounted on said shaft and moved to open-circuit position by axial movement of said shaft, means located in a separate base section to prevent rotation of said shaft under certain conditions, said means to prevent rotation being releasable by movement of said shaft to disconnect said fixed and movable contact means.

24. A push-pull selector switch comprising a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, a plurality of insulating bodies stacked upon one another, a plurality of selector contact means on each body, separate members slidably mounted on and rotating with said shaft for operating the contact means of each body, cooperating fixed and movable contact means, said movable contact means being resiliently mounted on said shaft and movable to disengage said fixed contact means by axial movement of said shaft and means to prevent rotation of said shaft, said means to prevent rotation being released by movement of said shaft for circuit opening of said bridging contact means.

25. A push-pull selector switch comprising a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, a plurality of selector contact means, a plurality of separate cam means slidably mounted on and rotating with said shaft for operating different contacts of said selector contact means, cooperating fixed and movable contact means, said movable contact means being resiliently mounted on said shaft and movable to disengage said fixed contact means by axial movement of said shaft, a second movable contact means mounted resiliently on said shaft, fixed contact means normally unengaged but engageable by said second movable contact means by axial movement of said shaft while the first movable contact remains engaged, and means to prevent rotation of said shaft, said means to prevent rotation being releasable by movement of said shaft for circuit opening movement of said movable contact means.

26. A push-pull selector switch as claimed in claim 25 wherein said engagement of said fixed contact means by said second movable contact means occurs on movement of said shaft in a particular direction, the rotation of said shaft being prevented when the shaft is moved in that particular direction and also when said shaft is in a neutral position, the switch being further characterized in that movement of said shaft from neutral in a direction opposite to said particular direction causes the disengagement of the first fixed and movable contact means and release of said rotation-preventing means.

27. In a push-pull selector switch, a rotatable shaft, manual operating means connected with

said shaft to rotate and to move said shaft axially, selector contact means, cam means slidably mounted on and rotating with said shaft for operating said selector contact means in combination with cooperating fixed and movable contact means, movable contact means being resiliently mounted on said shaft and moved to open-circuit position by axial movement of said shaft, means to prevent rotation of said shaft comprising a locking plate and means on said shaft engageable in a plurality of different angular positions with said plate to keep the shaft from rotating, said keeping means being disengageable from said plate to permit shaft rotation upon axial movement thereof in direction to open said fixed and movable contact means.

28. In a push-pull selector switch, a rotatable shaft, manual operating means connected with said shaft to rotate and to move said shaft axially, selector contact means, cam means slidably mounted on and rotating with said shaft for operating said selector contact means, in combination with cooperating fixed and movable contact means, said movable contact means being resiliently mounted on said shaft and moved to open-circuit position by axial movement of said shaft, means to prevent rotation of said shaft comprising a locking plate and means on said shaft engageable in a plurality of different angular positions with said plate to keep the shaft from rotating, said keeping means being disengageable from said plate to permit shaft rotation upon axial movement thereof in direction to open said fixed and movable contact means, and indexing means to locate said shaft when rotated into dif-

ferent angular positions, said keeping means engaging said indexing means to cause rotation in unison.

29. In a push-pull switch, an interlocking section, a selector section and a control section, operating means movable into a plurality of rotary and axial positions, said interlocking section comprising a base, means associated with said operating means and base and interlocking to prevent rotation of the operating means, said interlocking means becoming ineffective on predetermined axial movement, and said control section comprising contact means operated by movement of said operating means into and from certain axial positions to make and break power line connections, and said selector sections each comprising individual base members, fixed and movable contact members, and members rotating with said operating means but slidable relatively thereto to operate said movable contacts on rotation of said members to select and establish different circuits.

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