April 7, 1959

C. A. PARKER

2,881,272

ROTARY SEQUENCE SWITCH

Filed Oct. 4, 1957

FIG. 1

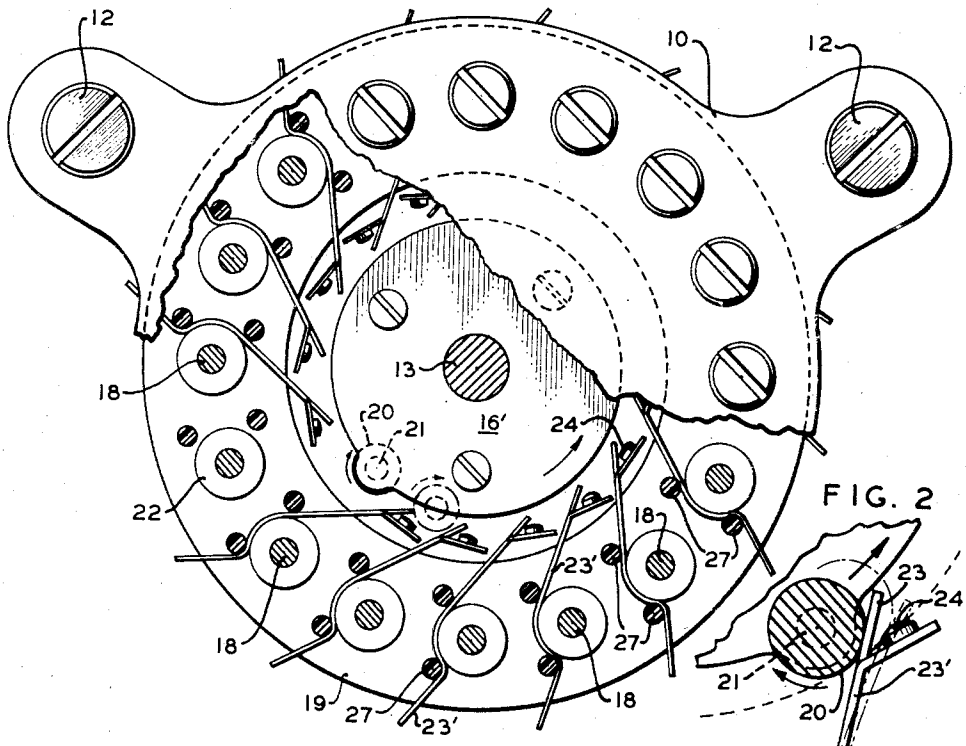


FIG. 2

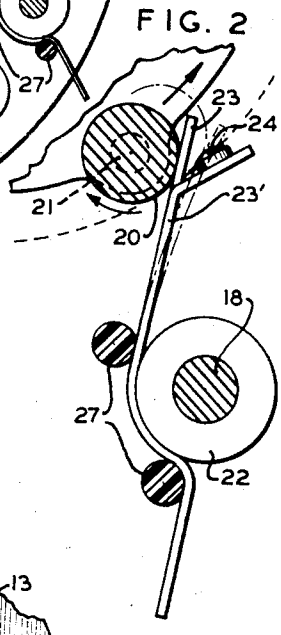
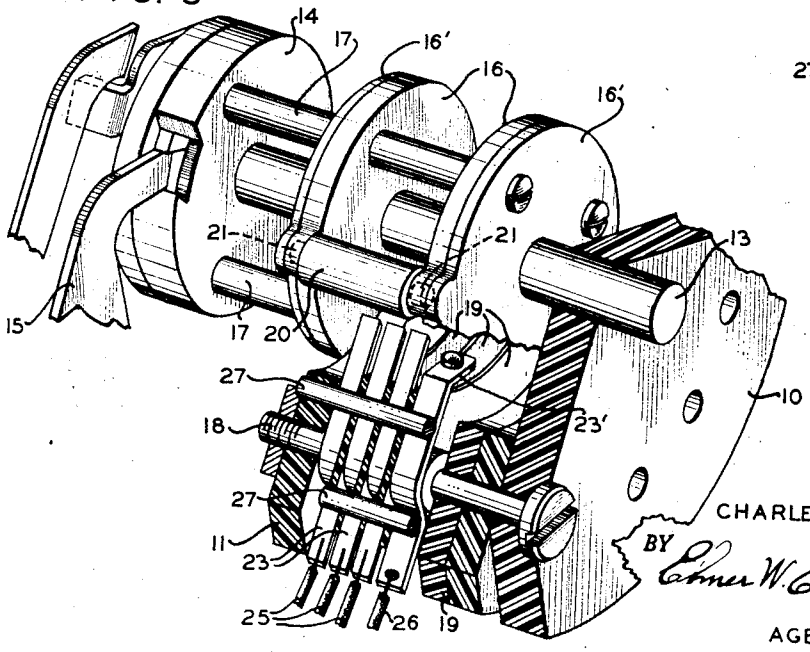


FIG. 3



INVENTOR.
CHARLES A. PARKER
BY Elmer W. Edwards
AGENT

United States Patent Office 2,881,272 Patented Apr. 7, 1959

2,881,272

ROTARY SEQUENCE SWITCH

Charles A. Parker, East Orange, N.J., assignor to Monroe Calculating Machine Company, Orange, N.J., a corporation of Delaware

Application October 4, 1957, Serial No. 688,364

10 Claims. (Cl. 200—8)

The present invention relates to electric switches of the rotary type and more particularly to such a switch wherein a plurality of contact arms are mounted upon a stationary portion of the switch to form a series of sequentially arranged groups of contacts which are caused to be engaged relative to successive groups in novel manner by a circuit bridging means carried upon the rotatable armature of the switch devices.

It is usual in the well-known computing machines employing switchboard devices or the like wherein a plurality of coded circuits are utilized for the translation of amounts into or out of one machine for the purpose of controlling another to effect the translating operations sequentially from either the higher to lower or from a lower to higher of the denominational orders provided in the machine. The coded arrangements embody a plurality of branch control circuits related to each order and each individual branch circuit includes a make and break circuit means related thereto. It is of advantage to have such plurality of make and break circuit means related to the corresponding orders of the branch circuits operate simultaneously in order to obtain a maximum number of places and speed of operation for a given switch size. Also, for computing machines of the above character it is imperative, in order to avoid miscalculations which are not readily observable, that the electrical contact elements of such make and break means be free of any contact corrosion and other foreign matter which would act to impair the efficiency or dependability of the switch.

A principal object of the present invention therefore is to provide a dependable rotary switch means adapted for rapid operation and which will act to assure a clean contact circuit engagement.

Further, the invention provides for sequence switch means including a rotatable armature having a circuit contact element thereon adapted for successively bridging groups of sequentially arranged fixed contact arms and in which the said circuit bridging element serves also to effect a novel cleaning operation of the circuit engaging areas of the said contact arms.

As another object the invention provides rotary switch means in which preliminary dead circuit engagement of a circuit bridging element is effected with successive groups of contact arms and subsequent to each said engagement a live circuit engagement thereof is effected with a related contact arm corresponding to each of the said groups and wherein said element thereafter releases the live circuit contact prior to a subsequent release of the related group of contact arms from said element.

Another object of the invention is the provision of sequence switch means in which a rotary armature has carried thereon a freely rotatable circuit bridging element adapted for engagement with successive groups of resilient contact arms and wherein said groups are arranged in spaced sequential order in an arc about the pivot shaft for said armature in such manner as to

effect a rolling operation of the bridging element over the contact area of a master contact arm corresponding to each of the said groups.

Another object of the invention resides in the arrangement of adjacent groups of contact arms wherein a spinning operation is effected to the bridging element in leaving one group of contact arms whereby said element effects a whirling engagement with a subsequent group of contact arms.

As a further object the invention provides means for effecting a rolling line to line engagement of the rotatable circuit element with the said contact area of the master contact arms of each of said groups.

Another object of the invention is to provide a bridging contact element adapted to control the duration of the on and off phase of successive uniform time circuit signal impulses.

With the above and other objects in view, the nature of which will appear as the description proceeds, the invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

In the accompanying drawings:

Fig. 1 is a right side elevation of the switch with the casing being broken away to show the sequentially arranged fixed contact pins and the contact bridging element carried by the rotary armature.

Fig. 2 is an enlarged detail view illustrating operation of the bridging contact element in moving from a dead circuit to live circuit engagement with a group of the fixed contact arms.

Fig. 3 is a perspective view of the switch devices looking from the right and showing a clutch means for effecting power operations of the switch.

Referring to the drawings, the switch device forms a compact unit in which the circuit elements are contained within suitable end plates **10—11** constructed of dielectric material and which may be mounted to any suitable support by screw means **12**.

Mounted centrally within end plates **10—11** and extending beyond to the left thereof is a shaft **13** adapted for rotation by means of a well-known cyclic clutch device **14** adapted for operation under control of the computer devices and in which operation immediate release of the clutch control pawl **15** effects one cycle of operation of shaft **13** while repeated operations of the shaft are effected by holding said pawl in operated condition.

Fast upon shaft **13** is a pair of insulation discs **16**, said discs being tied together and also to the driven portion of clutch **14** by suitable tie rods **17**, so that said discs form a rotatable armature of the switch devices.

Arranged within plates **10—11** and forming a concentric circle around the pivot shaft **13** for armature **16** are a plurality of support rods **18**. Mounted upon all the rods **18** are a plurality of insulation discs **19** having a central opening of sufficient size whereby a contact element **20** carried by armature **16** is free to revolve therein about shaft **13**. For the purpose hereinafter described, contact element **20** is provided with trunnions **21** bearinged for rotation within the armature discs **16** and in order that said contact element may be more freely rotated suitable plates **16'** secured to the outer face of each disc **16** will act to engage the end surfaces of the trunnions to maintain a slight clearance between the contact element **20** and the inside face of the discs **16**. Mounted upon each of the rods **18** and being spaced therein in alternate manner with each of the said discs **19** are four insulation collars **22** around each of which

partially extends a spring leaf contact arm 23, so that four contact arms 23 are arranged in groups upon each of the rods 18. Contact arms 23 are each held in position against the respective collars 22 by means of a pair of insulating rods 27 extending transversely thereof and mounted within end plates 10—11. The distal end of three of the contact arms 23 extends uniformly inwardly of the orbit described by contact element 20 of armature 16, whereby during counterclockwise operation of armature 16 said contact element will simultaneously strike the said three related arms 23 in each of the successive groups.

The fourth contact arm of each group and identified by the numeral 23' has the corresponding distal end portion thereof bent away from the related group of contacts 23 in the direction of movement of contact roller 20. Each contact arm 23' has fast upon the said bent portion thereof a contact member 24 having a convex surface, of silver or other like electrical conductive material, which partially projects within the orbital movement of the contact roller 20. Three contact arms 23 of each group are connected to normally dead circuit leads 25 extending to suitable control devices, while the contact arms 23' related to each group are connected by circuit lead 26 to a suitable live circuit control source. The arrangement of contact member 24 to the groups of related contact arms 23 is such that during operations of armature 16 the contact roller 20 first simultaneously bridges the three dead contact arms 23 of a group and will while still in engagement therewith immediately thereafter effect an electrical circuit to each of said arms by engaging the related contact member 24, as illustrated by the dotted line position of Fig. 2. It is to be observed that in the above described operation roller 20 during engagement with contact arms 23 will be frictionally rotated on the trunnions 21 and is thereby caused to effect a rolling engagement across the convex surface of contact member 24, so that roller 20 effects an efficient line to line circuit engagement with contact member 24 and with a minimum of wear. As the roller 20 is carried further by a continued movement of armature 16 it is caused to be carried out of engagement with contact member 24 prior to the release of said roller from the contact arms 23, whereupon the circuit will be broken to the said contact arms 23 before their release from roller 20 and will thus avoid any arcing and pitting at the respective circuit contact areas thereof.

In such a group of contact arms 23 and particularly wherein said contact arms present a substantial contact area corrosion and other foreign matter may gather thereon and thus adversely affect electrical contact between the surfaces thereof and the contact roller 20. In order to minimize such condition and assure of clean efficient electrical contact surfaces, while at the same time minimizing the impact of roller 20 when engaging each of the groups of contacts, the contact arms 23 are disposed angularly for inclined engagement at their tangent point to the counterclockwise operation of roller 20, as carried by armature 16, and said roller acts to effect novel cooperation with contact arms 23, as in the following manner.

As earlier set forth the groups of sequentially arranged fixed contact arms are spaced equally apart. However, if desired one of the groups of contacts may be omitted at the normal home position of the switch devices, as shown in Fig. 1. It will be noted that each time armature 16 carries roller 20 away from engagement with a group of the resilient contact arms 23 said arms in springing back to their normal condition will act to impart a freely spinning operation to the contact roller 20 in a clockwise direction. In the normal speed of operations of the switch devices such spinning operation will be sufficient so that subsequent engagement of roller 20 will be effected with the adjacent group of contact arms 23 while roller 20 is still freely spinning. Thus by virtue of said spinning movement of the roller by armature 16 with respect to contact arms 23 a whirling engagement of roller 20 is effected with contact arms 23 and will act to effect a clean wiping action on each of the contact areas thereof.

In the switch devices illustrated in the drawings the diameter of contact roller 20 is proportioned relative to the space factor between the adjacent fixed groups of contacts whereby the on circuit time phase of the switch is approximately equal to that of the off circuit time phase. Rotary switch devices of the type herein disclosed, however, are applicable to various uses and it may be that for some uses a longer on circuit time may be desired to the off circuit time phase, or vice versa. The switch devices herein disclosed are readily adapted to such variations by merely substituting for the present roller 20 shown a roller of slightly greater diameter so as to increase the on circuit time phase while decreasing the off circuit time phase, or, by decreasing the diameter of the contact roller slightly a shorter on time circuit with longer off time of circuit is obtained between the successive groups. Where even greater variations in the on and off time phase are desired the pivot center for the roller may be shifted slightly so as to permit greater variations to the roller sizes without altering the maximum radius of the orbital path traversed by the rollers around the shaft 13.

While there has been shown and described a preferred embodiment of the present invention it will be obvious that changes in form and details of the device may be made by those skilled in the art, and it is, therefore, contemplated to cover by the appended claims any such modifications as fall within the true spirit and scope of the invention.

What I claim is:

1. An electric switch comprising a support member having mounted thereon a plurality of electrically insulated contact arms arranged in sequentially spaced groups and at least one of which in each group is electrically inactive and another of which is electrically active, a support member having insulatedly mounted thereon a contact element adapted for effecting a bridging engagement with successive groups of the said contact arms during relative movement between said support members, and wherein said contact arms are disposed relative to said movement of the contact element whereby for each group said contact element effects during said successive engagements first inactive circuit engagement with given inactive ones of said contact arms of a group and thereafter will bridge said inactive contact arms with an active contact arm of the related group to effect an electrical circuit, and wherein the said contact element will thereafter release the said active bridging circuit prior to a release thereof from the first said engaged contact arms of the related group.

2. An electric switch comprising support means having a freely rotatable contact element mounted thereon, a support means upon which is mounted resilient contact arms adapted for engagement by said contact element during relative movement between said support means, and wherein a resilient contact arm includes a contact area disposed angularly to said movement and another of said contact arms includes a contact surface disposed substantially parallel to said movement, and wherein an engagement of said contact element is effected with the said angularly disposed contact surface prior to a subsequent engagement of said element with the said parallelly disposed contact surface, and wherein during said movement the angularly disposed contact surface will act to cause a rolling action to the impact of engagement of the rotatable contact element with the parallelly disposed contact surface.

3. The invention according to claim 2 and wherein the said subsequently engaged contact surface includes a convex area extending within the path of movement

relative to the rotatable element whereby said element will effect a line to line engagement therewith.

4. A sequence switch comprising a support member having mounted stationarily thereon a plurality of sequentially spaced resilient contact elements, a second support member and having mounted thereon a freely rotatable contact element, means for causing relative movement between said support members to effect engagement of the rotatable contact element with successive groups of the spaced resilient contact elements, and wherein said resilient contact elements during said engagement are caused to be energized by said movement and will impart a freely spinning operation to the rotatable element when disengaging therefrom, whereby the said rotatable element subsequently effects wiping action with an adjacent one of said spaced contact elements by a whirling engagement therewith.

5. A sequence switch comprising a fixed support member having a plurality of resilient contact arms insulatedly mounted thereon to form sequentially spaced groups of related electrical contacts, a support member movable relative to said first support member and upon which is mounted a freely rotatable electrically insulated contact element extending transversely of each of said groups of contact arms, and wherein a plurality of said contact arms for each group are inclined uniformly within the path of movement of said contact element, a contact pin related to each group of said contact arms and adapted for engagement by said contact element subsequent to engagement of said element with the related group of said contact arms, and wherein engagement of said contact element with said contact arms will act to cause a rolling impact engagement of said contact element with said related contact pins.

6. A rotary sequence switch comprising a fixed support means, a plurality of resilient contact arms spaced thereon in a plurality of uniform concentric circles so as to form sequentially spaced groups of related contact arms, a rotatable armature bearinged within said support means, a freely rotatable contact element insulatedly carried on said armature and extending transversely of the groups of said contact arms, and wherein a plurality of contact arms of each group are included uniformly within the path and direction of orbital movement of said contact element whereby simultaneous bridging engagement of said arms is effected by said contact element in successive groups with a cushioned impact, and wherein continued operation of said armature in releasing the said resilient contact arms will cause said arms to impart a spinning rotational movement to the said contact element whereby a subsequent engagement thereof with an adjacent one of the groups of said contact arms is effected with a whirling wiping action.

7. A selector switch comprising a series of sequentially arranged groups of spaced apart resilient contact members adapted to be connected in separate branch electrical circuits, a mounting frame for said contact members, a rotatable shaft supported therein and having fast thereon an insulating arm carrying a freely rotatable contact roller adapted in an operation of said shaft to electrically bridge each of the successive groups of said resilient contact members, and wherein certain of the bridged contact members are inclined so as to be engaged in angular manner by said contact roller, and wherein a distal end of a contact member of each group is bent sufficiently to coincide substantially with the path of orbital movement of said contact roller by said shaft, a contact pin positioned on each of the said bent end portions and being engageable by the said contact roller subsequent to an initial engagement of the roller with the related said inclined contact members and wherein the said contact pin is thereafter disengaged from the said roller before the roller is released from the related group of said inclined contact members.

8. The invention according to claim 7 and wherein the groups of contact members are angularly disposed to extend coincident with the related contact pin sufficiently so that during an engagement of said roller with each inclined group of contact members rotation effected to said roller by said engagement will cause the roller to move across the related contact pin with a rolling action having a minimum of friction therewith.

9. The invention according to claim 8 and wherein the resilient contact members during release of the contact roller therefrom act to augment the rotational movement of said contact roller and impart freely spinning rotation whereby said roller engages an adjacent group of said contact members in a whirling operation adapted to the purpose of effecting a wiping action therewith.

10. The invention according to claim 7 and wherein an on circuit time interval relative to an off circuit time interval as between the engagement of said contact roller with each adjacent group of said sequentially arranged groups of contact members is adapted to be predetermined in accordance with a variation in diameter size of said contact roller.

References Cited in the file of this patent

UNITED STATES PATENTS

2,418,616	Batcheller	Apr. 8, 1947
2,658,963	Krahulec	Nov. 10, 1953
2,671,836	Auger et al.	Mar. 9, 1954

FOREIGN PATENTS

343,182	France	July 29, 1904