Nov. 21, 1961 E. B. GRAVES ET AL 3,009,993

MULTIPLE POINT SWITCH

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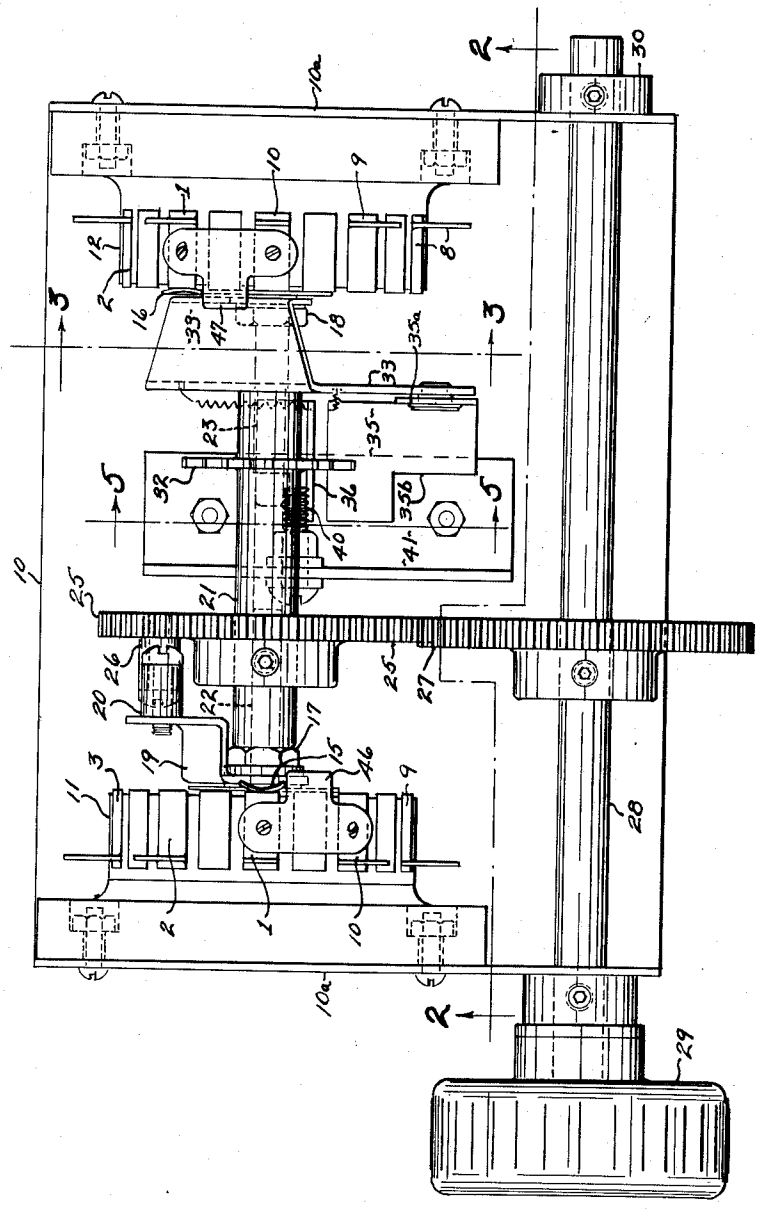


FIG. 1

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MULTIPLE POINT SWITCH

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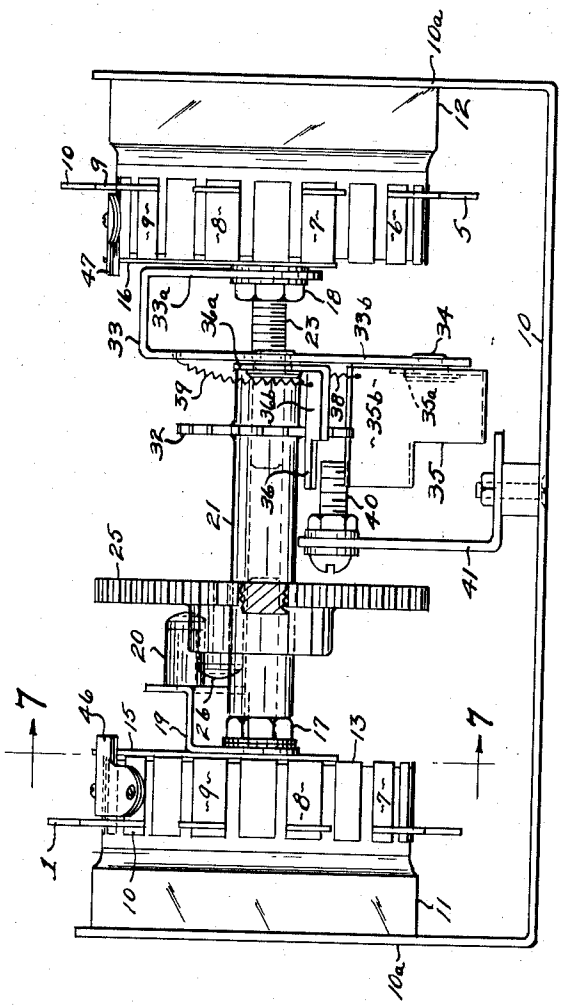


FIG. 2

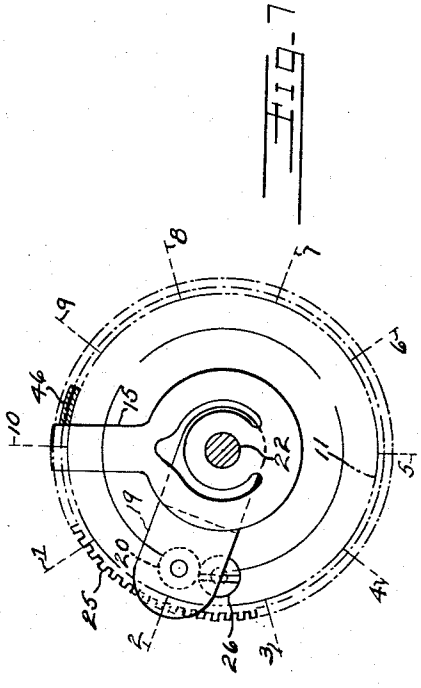


FIG. 7

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MULTIPLE POINT SWITCH

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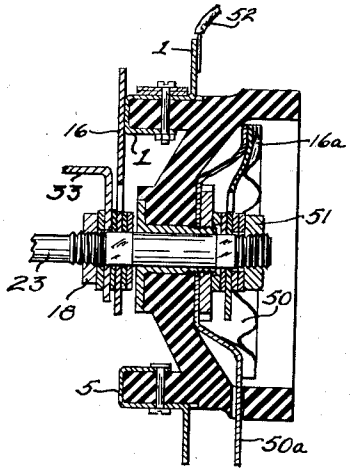



FIG. 4

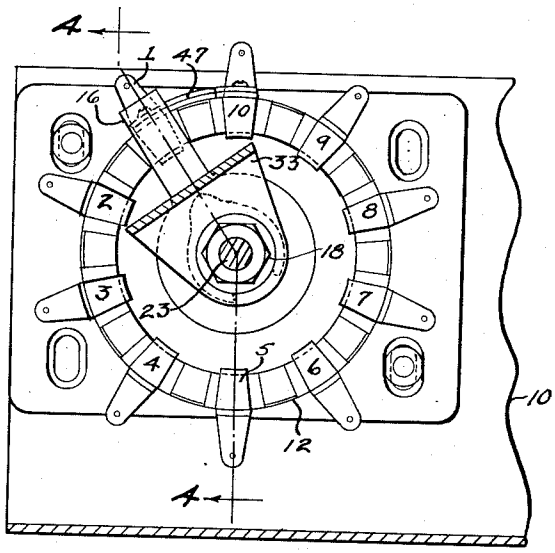



FIG. 3

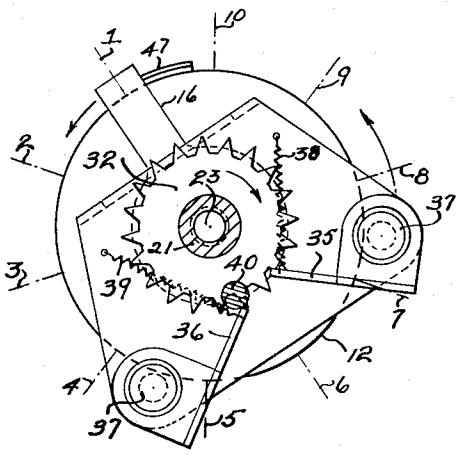



FIG. 5

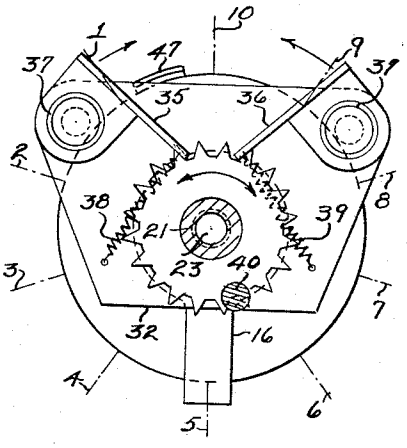



FIG. 6

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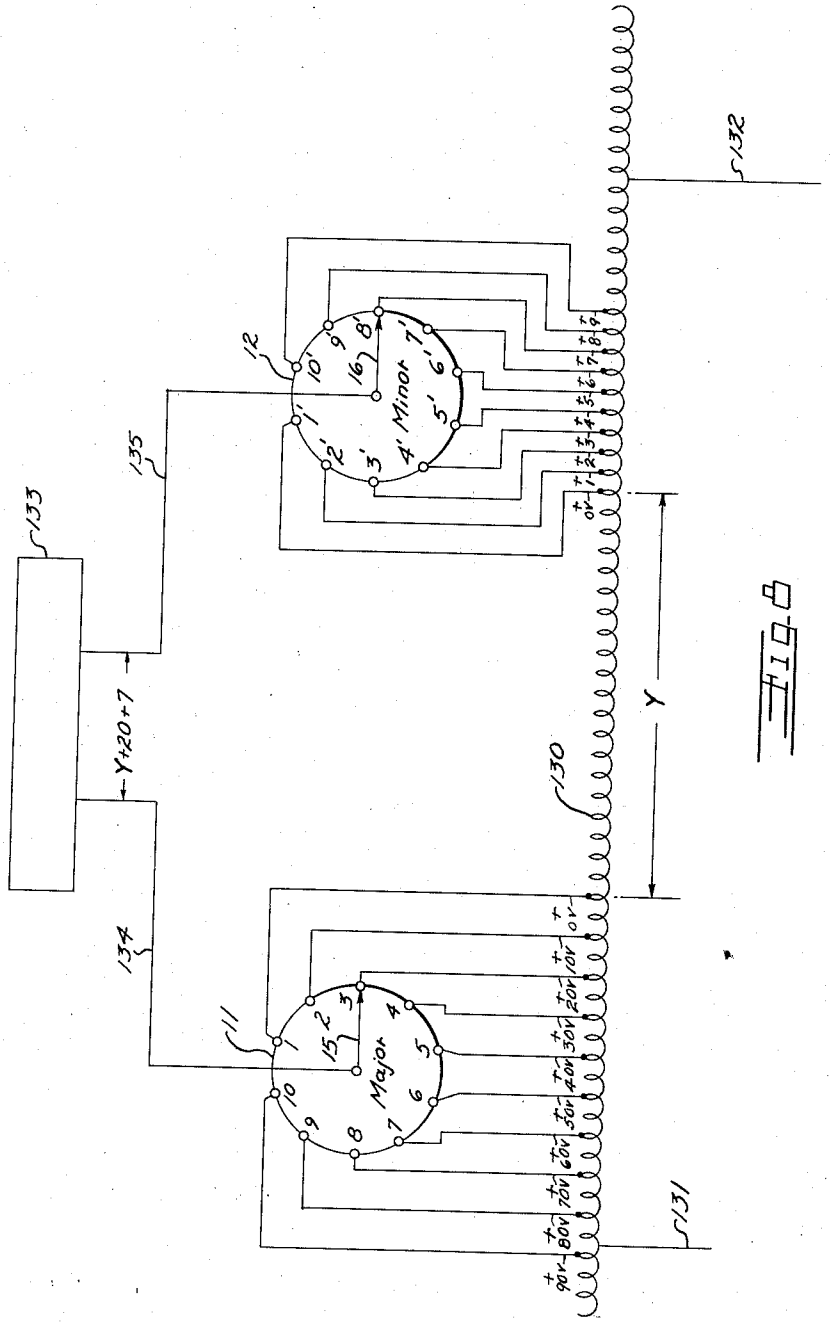



FIG. 8

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MULTIPLE POINT SWITCH

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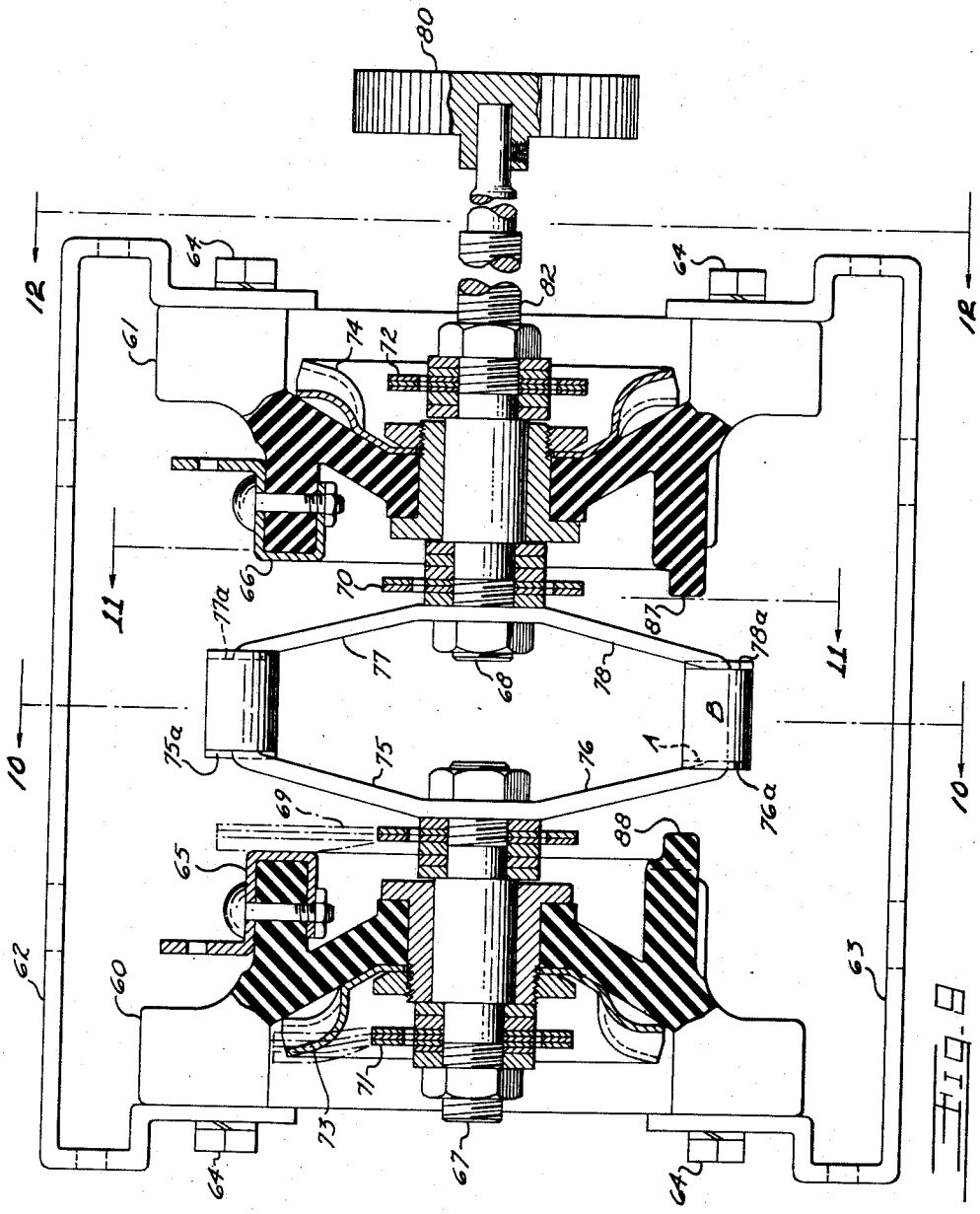



FIG. 8

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MULTIPLE POINT SWITCH

Filed April 9, 1956 8 Sheets-Sheet 6

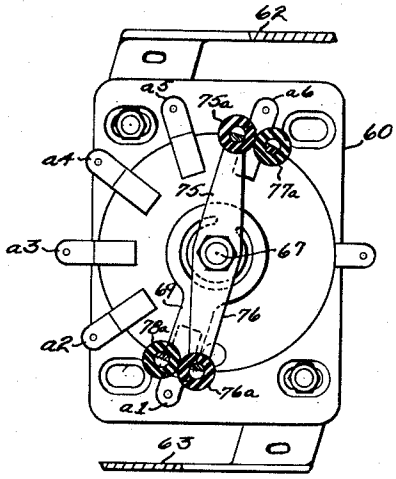



FIG. 10

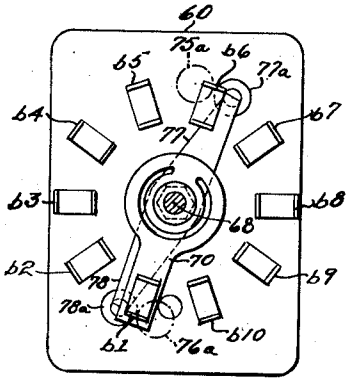



FIG. 11

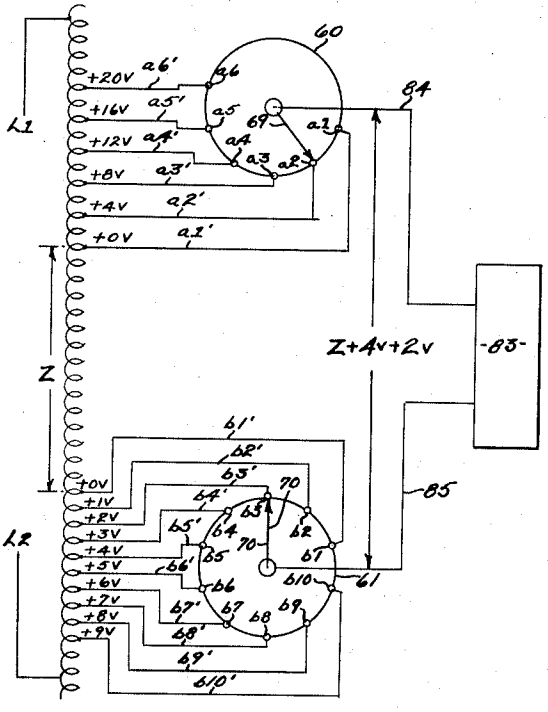



FIG. 13

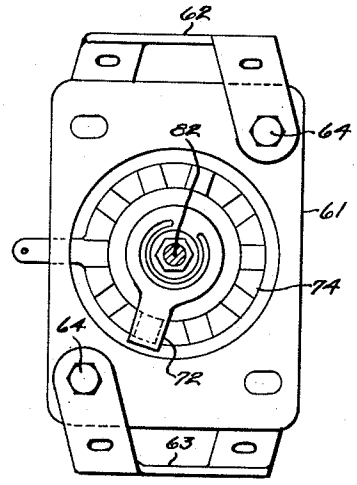



FIG. 12

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MULTIPLE POINT SWITCH

Filed April 9, 1956 8 Sheets-Sheet 7

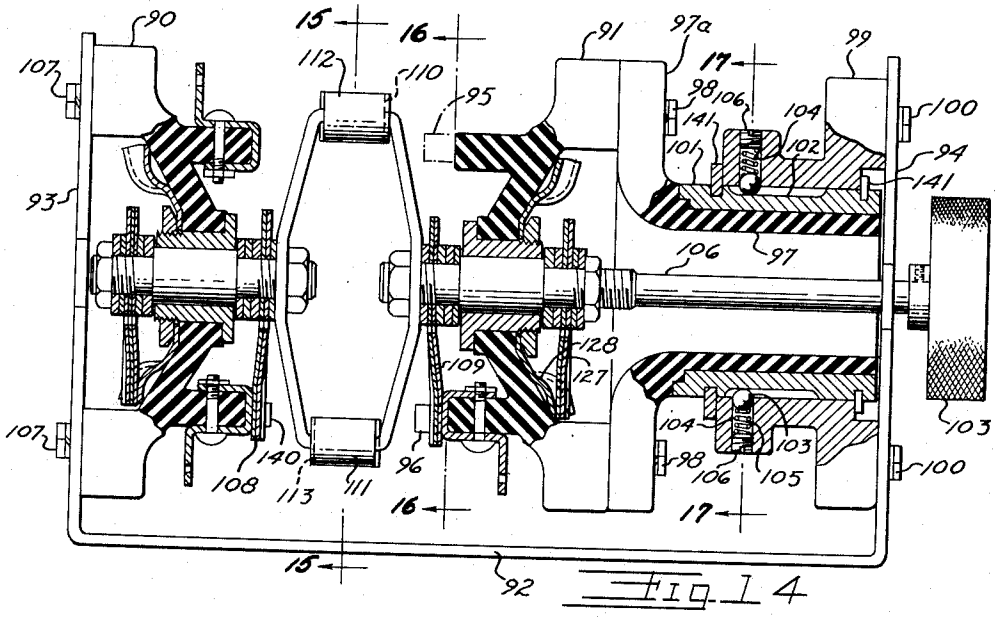



Fig. 14

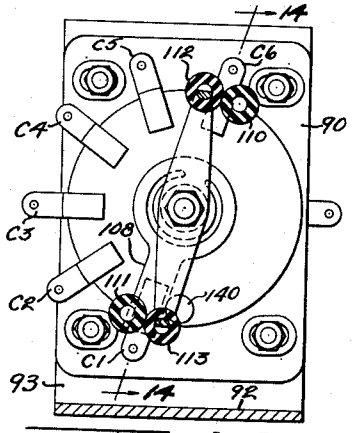



Fig. 15

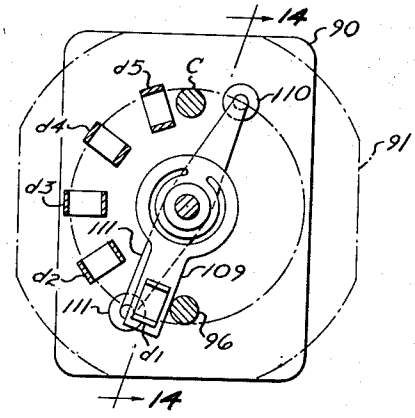



Fig. 16

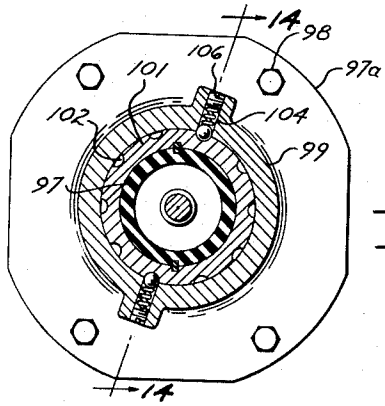



Fig. 17

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Filed April 9, 1956

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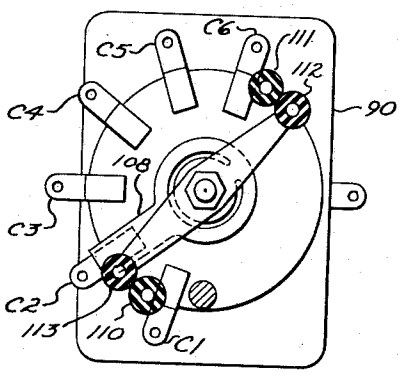



FIG. 18

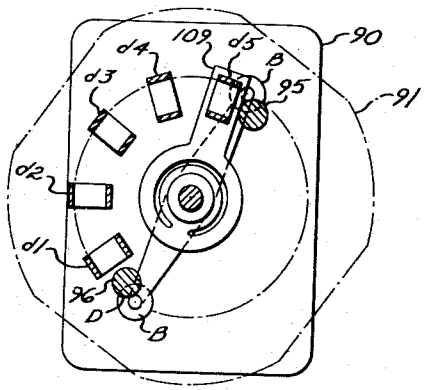



FIG. 19

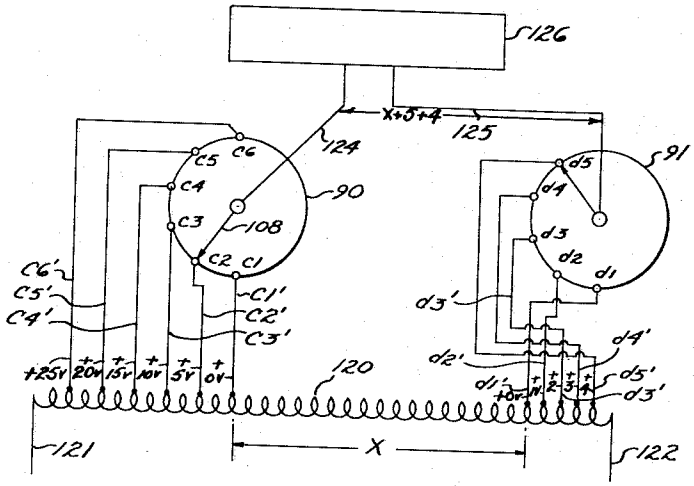



FIG. 20

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United States Patent Office 3,009,993 Patented Nov. 21, 1961



3,009,993

# MULTIPLE POINT SWITCH

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Filed Apr. 9, 1956, Ser. No. 577,002
26 Claims. (Cl. 200—14)

This invention relates to switches and more particularly to an electrical rotary switch for selectively controlling the voltage of a current flowing therethrough.

An object of this invention is to provide a switch having a plurality of interrelated circuits and contacts whereby different desired voltages may be quickly, easily and accurately selected by a person relatively unskilled in the art of manipulating switches.

Another object of this invention is to provide a rotary switch utilizing a plurality of stators and rotors, some of which have major voltage selection steps and others of which have minor voltage selection steps between their contacts to permit selective uniform voltage increases in the electricity flowing therethrough.

Still another object of this invention is to provide an electrical rotary switch, comprising a plurality of stators and rotors for uniform regulation of voltage, having but a single control knob by which an operator may precisely adjust the desired amount of voltage.

Another object of the present invention is to provide an electrical rotary switch characterized by its structural simplicity, the ease of assembly of its parts, its strong and sturdy nature and its low manufacturing cost. Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Further objects of the present invention and certain practical advantages will be referred to in, or will be evident from, the following description of three embodiments of the present invention, as illustrated in the accompanying drawings, in which:

FIG. 1 is a top plan view of one form of the operating switch mechanism.

FIG. 2 is a side elevation view of the same with the main drive shaft and control knob removed.

FIG. 3 is a vertical sectional view taken along the plane of line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken along the plane of line 4—4 of FIG. 3.

FIGS. 5 and 6 are enlarged fragmentary views taken along the plane of line 5—5 of FIG.1, showing the operation of the ratchet wheel and driving dogs or pawls for rotating one of the rotors.

FIG. 7 is an enlarged vertical cross sectional view taken along the plane of line 7—7 of FIG. 2.

FIG. 8 is a wiring diagram used in connection with the embodiment of the invention illustrated in FIGS. 1 to 7.

FIG. 9 is an enlarged central sectional view of another embodiment of the present invention.

FIG. 10 is a transverse sectional view on a smaller scale taken along the plane of line 10—10 of FIG. 9.

FIG. 11 is a transverse sectional view on a smaller scale taken along the plane of line 11—11 of FIG. 9.

FIG. 12 is an end view on a smaller scale taken along the plane of line 12—12 of FIG. 9.

FIG. 13 is a wiring diagram used in connection with the embodiment of the invention illustrated in FIGS. 9 to 12.

FIG. 14 is a central vertical sectional view of still another embodiment of the present invention.

FIG.15 is a transverse sectional view on a smaller scale taken along the plane of line 15—15 of FIG. 14.

FIG. 16 is a transverse sectional view on a smaller scale taken along the plane of line 16—16 of FIG. 14.



FIG. 17 is a transverse sectional view on a smaller scale taken along the plane of line 17—17 of FIG. 14.

FIG. 18 is a view similar to FIG. 15 but showing the rotating arms of the minor stator advanced clockwise substantially 180 degrees and the rotor of the major stator advanced clockwise one contact.

FIG. 19 is a view similar to FIG. 16 but showing the rotor of the minor stator advanced clockwise five contacts and the entire minor stator rotated clockwise through one indexing position.

FIG. 20 is a wiring diagram used in connection with the embodiment of the invention illustrated in FIGS. 14 to 19.

Before describing in detail the embodiments of the invention herein shown, it is to be understood that the present invention is not limited to the structural details or the particular arrangement of parts herein shown, as devices embodying the present invention may take other forms. It also is to be understood that the phraseology and terminology herein used are for purposes of description and not of limitation, as the scope of the present invention is denoted by the appended claims.

Referring now to the drawings, like reference numerals designate like parts throughout the various figures. As seen in FIGS. 1 and 2, the switch includes a generally U-shaped base frame or casing **10***a* which is of pressed metal or other suitable material. Mutually facing molded plastic insulating stators **11** and **12** of usual design are provided on the upstanding spaced end portions of the casing. Each of the stators is provided with a plurality of metallic contacts **1** through **10** arranged in a circle around its circumference and secured thereto. The stators **11** and **12** are provided on their inner faces with rotors **15** and **16** respectively. The rotors are rotatably secured to the central hubs **22** and **23** of the stators by means of suitable nuts **17** and **18** respectively. Each rotor projects radially outwardly from the center of the stator and is adapted to selectively engage the individual contacts provided on the stator. As best seen in FIGS. 1 and 2 rotor **15** and substantially Z-shaped member **19** are splined to shaft **22**. The Z-shaped member **19** is provided with an axially projecting arm or pin **20** extending away from rotor **15** toward stator **12**. A hollow axle member **21** is freely supported for rotation by means of bolt **22** which projects axially from the hub of stator **11** in alignment with the central hub of stator **12**. The outer end of hollow axle **21** is supported for rotation by means of bolt **23** which projects from the hub of stator **12**. It will be understood that the axle **21** is free to rotate independent of rotors **15** and **16**.

A driven gear **25** is rigidly mounted upon the hollow axle member **21**. The driven gear member is provided with an axially extending arm or pin **26** which is spaced the same radial distance from the axle **21** as the pin **20** provided on the Z-shaped member **19**. Pin **26** extends toward member **19** and travels in the same annular space as pin **20**. Thus, both of the pins **20** and **26** travel about the same radius and intersect one another during each revolution of the rotor **15** or gear **25**. For purposes of rotating the driven gear **25** and axle **21**, we have provided a driving gear **27** which is fixedly mounted on a longitudinally extending axle **28** which extends parallel to the axle member **21** but is spaced laterally therefrom. The ends of the axle **28** are journalled for rotation in the upstanding end portions of the casing **10***a*. One end of the axle is provided with a control knob **29**, as seen in FIG. 1, which may be grasped by the operator for rotating the switch mechanism. The other end of the axle **28** is secured to the casing **10***a* by means of an adjustable collar **30**. The teeth of the driving and driven gears **27** and **25** respectively are in meshing engagement,

as viewed in FIG. 1. Thus, it will be seen that upon rotation of the control knob **29** the axle **28** and driving gear **27** are caused to rotate with the effect of driving the driven gear **25** which causes the rotor member **15** to rotate about the stator **11** upon intersection of the pins **20** and **26**. The direction of rotation of member **15** will depend upon which side of pin **20** is engaged by pin **26**. The rotor **15** may thereby be selectively positioned upon any of the circumferentially spaced contacts **1** through **10** provided on the stator **11**.

For purposes of driving rotor member **16**, which is rotatably mounted on the stator **12**, we have provided a ratchet wheel **32** which is rigidly secured to the hollow axle member **21**. Suitable means are provided between the ratchet wheel **32** and the rotor **16** for causing the rotation of said rotor. Such means include a U-shaped bracket **33** having one of its legs **33***a* secured in tight frictional engagement with rotor **16** by means of nut **18** while the other and longer leg **33***b* of the U-shaped bracket member **33** extends substantially parallel to but spaced from the plane of the ratchet wheel **32**, as viewed in FIGS. 1 and 2. The leg **33***b* lies between rotor **16** and ratchet wheel **32**. Pivotally secured to the outer face of the longer leg **33***b* of bracket **33** are a pair of opposed or right- and left-hand acting dogs or pawls **35** and **36** respectively. Each pawl comprises a substantially L-shaped member, one leg **35***a*, **36***a* of which is pivotally secured to the outer face of bracket **33** by means of pivotal pins **37**. The other leg **35***b*, **36***b* extends axially outwardly to engage the teeth of the ratchet wheel **32**. Each of the pawls is provided with suitable resilient means which herein takes the form of a coil spring **38** and **39** respectively fastened between the pawls and bracket **33** to urge the axially extending leg **35***b*, **36***b* of each pawl into engagement with the teeth of ratchet wheel **32**. As seen in FIG. 6, when the ratchet wheel is turned by shaft **21** in a clockwise direction, the right pawl **36** is engaged and driven by the ratchet wheel while the left pawl **35** is merely carried along by bracket **33** and rides over the ratchet wheel teeth. The reverse is true when the ratchet wheel **32** is turned in a counterclockwise direction, as viewed in FIG. 6; then the left pawl **35** is driven and the right pawl **36** merely slips over the teeth of ratchet wheel **32**. Thus it is seen that rotor **16** may be rotated in either direction simply by turning the control knob **29** which in turn rotates drive gear **27** and driven gear **25** thereby causing ratchet wheel **32** to rotate in response to rotation of hollow axle **21**; the ratchet wheel **32** in turn drives the pawls **35** or **36** depending upon the direction of rotation. The driving pawl imparts its driving force to the U-shaped bracket **33** through pivotal pin **37** and U-shaped bracket **33** through its frictional engagement with the rotor **16** causing said rotor to be rotated.

Suitable means are provided for disengaging the driving pawl at a particular point in the rotation of the rotor **16** while simultaneously turning the rotor **15** about stator **11**. Such means comprise an axially extending bolt or lug **40** which is supported adjacent the hollow axle **21** between driven gear **25** and ratchet wheel **32** by means of an L-shaped bracket **41** as best seen in FIG. 2, and rigidly secured to the base of the casing **10**. The pin is so positioned, in the path of rotation of the particular driving pawl, that it will engage the inner driving edge of the pawl and cause it to swing clear of the driving teeth of the ratchet wheel **32** as seen in FIG. 5. In FIG. 5, the ratchet wheel **32** is driving in a clockwise direction; thus pawl **36** had been the driving pawl while pawl **35** was merely carried along. In the position of FIG. 5, the driving pawl **36** is shown deflected out of the path of the driving teeth of the ratchet wheel **32** so that it can no longer drive the bracket **33** and rotor **16**. Pawl **35**, through the provision of resilient spring **38**, merely slips as the teeth of ratchet wheel **32** pass by it. Thus, it is seen that one of the pawls is driven by the ratchet wheel while the other pawl passively follows until the driving pawl engages the outstanding projection pin **40**, whereupon it is removed from driving engagement with the ratchet wheel. Continued rotation of the ratchet wheel causes the other or non-driving pawl to slip as viewed in FIG. 5 to permit continued turning of the ratchet wheel without rotating the bracket **33** and rotor **16**, and at the same time turning rotor **15** about stator **11**.

As seen in FIG. 3, the stators are provided with ten equally spaced circumferentially positioned metal contacts. In the present construction stator **11** is meant to be the major stator while **12** is the minor stator. The major stator **11** has ten contacts which are major voltage selection steps of say 10 volt multiples while minor stator **12** has ten contacts which are minor voltage selection steps of say 1 volt multiples. Thus, it will be seen that the movement of rotor **15** from one contact to the adjacent contact of major stator **11** exceeds by the value of one minor step a complete revolution of rotor **16** about the minor stator **12**. The switch is so designed and the parts so positioned that whenever pins **20** and **26** engage one another so as to drive rotor **15** about the major stator **11**, the driving pawl (**35** or **36**, whichever it may be) is simultaneously in engagement with the projecting pin **40** and is thereby rendered ineffective to drive rotor **16** of minor stator **12**. It will also be understood that when either driving pawl is in engagement with the projecting pin **40** the rotor **16** is so constructed and positioned as to be in contact with either contact **1** or contact **10** of the minor stator **12**. Thus, if it were desired to have a setting of say 25 volts (plus voltage Y), the control knob **29** would be rotated so that the pin **26** would engage pin **20** of arm **19** and the rotor **15** advanced two contacts on the major stator **11** so that a total of 20 volts would flow through the major stator. At this point rotor **16** would be positioned on the tenth contact of minor stator **12** and would not have moved away from this point due to rotation of the control knob since the driving pawl would habe been disengaged by projecting pin **40**. Thus an additional amount of 9 volts is flowing through the minor stator **12** thereby supplying a total of 29 volts from the switch. In order to produce the desired voltage of 25 volts, the operator would then reverse the direction in which he had turned control knob **29** so that pin **26** will no longer engage pin **20** and the rotor **15** of major stator **11** remains in contact with the third contact while the ratchet wheel **32** is in driving engagement with pawl **35** so as to rotate rotor **16** in a direction wherein said rotor becomes positioned in engagement with the sixth contact of minor stator **12**, to reduce the total voltage flowing from the switch from **29** to the desired number **25**. Should it be desired to step the voltage up to **39**, the control knob would again be rotated in its original direction thereby causing the opposite pawl **36** to rotate the rotor **16** of minor stator **12** until it once again engaged the tenth contact whereupon the pawl would be rendered ineffective by projecting pin **40** and the driving operation would cease and simultaneously the pin **26** would engage pin **20** and rotor **15** of major stator **11** would be advanced to the fourth contact thereby adding 10 volts wherein a combined voltage of 39 would be flowing from the switch. All voltages selected by the switch are in addition to the minimum voltage Y from the transformer.

This particular arrangement is desirable so that the voltage can be increased by uniform steps and any desired voltage thereby obtained. It should be noted that limiting stops **46** and **47** are provided on the top surface of the major and minor stator members respectively to engage their rotors and thereby limit their directional rotation. Thus, the rotor of the minor stator could not pass from the tenth contact to the first contact without first being rotated in a reverse direction past the various other contacts.

As seen in FIG. 4 each outer contact of the major and minor stators is provided with aligned inner contact grooves and ridges on a contact plate **50** which is simul-

taneously engaged by a secondary rotor **16***a* mounted on the shaft **23** by means of suitable nuts **51**. Thus, the current is fed to the contact plate **50** by means of a feed **50***a* and selectively transferred to the inner rotor **16***a*, thence through the electrically conducting shaft **23** to outer rotor **16** and selected contact (**1** to **10**) into the outlet wire **52** connected to the outer contact. The grooves and ridges of contact plate **50** tend to retain the rotor **16** in any selected position, rotor arm **16***a* springing from groove to groove.

In FIG. 8 we have shown a wiring diagram which relates specifically to the embodiment of the present invention shown in FIGS. 1 through 7. An autotransformer **130** is connected to a suitable power source by lines **131** and **132**. The major stator **11** is provided with ten contacts **1**, **2**, **3**, **4**, etc., which are major voltage selection steps of say ten volt multiples. Each of the ten contacts **1**, **2**, **3**, **4**, etc. has a lead wire respectively associated therewith, so that they may be tapped into the autotransformer at spaced distances to provide a total of ten volts between each of the contacts. The minor stator **12** has ten contacts **1'**, **2'**, **3'**, **4'**, **5'**, etc., each of which is a minor voltage selection step of say one volt multiple. Each of the contacts of the minor stator **12** is provided with a suitable lead line to add one volt for each contact. As heretofore explained, the major and minor stators are provided with rotors **15** and **16** respectively which selectively engage these various contacts of their associated stator. The central pivot of the major rotor **15** is connected to a load circuit **133** by means of line **134** while the central pivot of the minor rotor **16** is connected to said load circuit by means of line **135**. Obviously, the central pivots of rotors **15** and **16** are electrically insulated except for the circuits described. It will be understood that the movement of rotor **15** from one contact to the adjacent contact of the major stator **11** exceeds by the value of one minor step to a complete revolution of the rotor **16** about the minor stator **12**. Thus, in the position shown in FIG. 8 wherein the rotor **15** of the major stator is positioned on contact **3**, a total of twenty volts (additional to Y) would be flowing through the major stator to the load circuit **133** and an additional seven volts would be flowing from the minor stator **12** since rotor **16** is positioned in engagement with contact **8**. Thus, a total of twenty plus seven or twenty-seven added volts are flowing to the load circuit. This voltage is in addition to the constant voltage across "Y" which may be set at any desired amount.

In FIGS. 9 through 13 we have shown a modified embodiment of the present invention. Here, a pair of spaced concentric major and minor insulating stators **60** and **61** respectively are retained in the rigid position shown in FIG. 9 by means of suitable side brackets **62** and **63**. The brackets **62** and **63** are secured to the ends of the stators by means of screws **64**. The major stator **60** in the present embodiment is provided with a plurality of six spaced contacts *a***1**, *a***2**, *a***3**, *a***4**, etc. which are arranged arcuately about a portion of the major stator, as seen in FIG. 10. The minor stator **61** in the present embodiment is provided with a plurality of ten contacts *b***1**, *b***2**, *b***3**, *b***4**, etc. which are spaced about the entire circumference of the minor stator. Each of the stators **60** and **61** is provided with a shaft **67** and **68** respectively which extend through the center of the stators in a rotatable fashion and each has rigidly secured thereto main rotors **69** and **70** respectively for engagement with the sets of contacts *a* and *b* respectively as the associated shaft revolves. Secondary rotors **71** and **72** respectively are positioned within the hollow interiors of the stators and have spring arms (see FIG. 12) adapted to engage their respective stop plates **73** and **74** which are provided with a plurality of grooves and ridges and retain the main rotors **69** and **70** in any selected contact-engaging position. The secondary rotor arms **71** and **72** spring from groove to groove about their respective plates **73** and **74**, as best seen in FIGS. 9 and 12. One of the main distinguishing features between the present embodiment and that heretofore described is found in the driving means for rotating the rotors about their respective stators. As seen in FIGS. 9 and 10, the rotatable shaft **67** of the major stator is provided with a pair of radially projecting arms **75** and **76** (these arms are constructed of a one-piece member). The arms are spaced 180 degrees apart and each is provided with an outstanding longitudinally extending portion, **75***a* and **76***a* respectively, which is covered with a suitable cylindrical resilient material, such as rubber. An identical pair of radially extending arms **77** and **78** are rigidly secured to the rotatable shaft **68** of the minor stator. The radially extending arms of the minor stator are provided with longitudinally extending portions **77***a* and **78***a* respectively which are also covered with suitable resilient rubber material. The resilient portions of the respective pairs of radially extending arms of both the major and minor stators intercept each other in the plane of line **10**—**10** of FIG. 9, and FIG. 10. A control knob **80** is rigidly connected directly to the rotatable shaft **68** of the minor stator **61** by means of a centrally located drive axle **82**. Rotation of the control knob **80** causes the radially extending arms of the minor stator **77** and **78** through their associated longitudinally extending portions **77***a* and **78***a* to intercept the arms **75** and **76** and their associated longitudinally extending portions **75***a* and **76***a* of major stator **60** after a maximum rotation of 180 degrees. From the position shown in FIG. 10 the minor rotor **70** may be moved only in a clockwise direction due to a stop **87** on stator **61** which engages rotor **70** to prevent counterclockwise movement. Stop **88** on major stator **60** engages rotor **69** to prevent further counterclockwise movement from the position of FIG. 10. Thus, it will be seen in FIG. 10 that the rotor of the minor stator may be moved through a maximum of 180 degrees in a clockwise direction or past five contacts before the rotor of the major stator is actuated through the intercepting arms described.

The major stator has six contacts, each of which is a major voltage selection step while the minor stator has ten contacts, each of which is a minor voltage selection step. Hereafter, let it be assumed that each contact of the major stator is equivalent to four volts and each contact of the minor stator is equivalent to one volt; in order to advance the rotor of the major stator one contact, it would be required that the arms of the minor stator be advanced from the position as shown in FIG. 10 in a clockwise direction.

Referring now to FIG. 13, I have shown a wiring diagram which relates specifically to the embodiment of the present invention shown in FIGS. 9 through 12. An autotransformer **82** is connected to a suitable power source by lines L1 and L2. The major stator **60** is provided with six contacts *a***1**, *a***2**, *a***3**, *a***4**, etc. which are major voltage selection steps of say four volt multiples. Each of the six contacts has a lead wire *a***1'**, *a***2'**, *a***3'**, *a***4'**, etc. respectively associated therewith and provided with a suitable contact at their free ends so that they may be tapped into the autotransformer at suitable spaced distances so that each adds a total of four volts from the autotransformer. The minor stator **61** has ten contacts *b***1**, *b***2**, *b***3**, *b***4**, etc. which are minor voltage selection steps of say one volt multiples. Each of the contacts of the minor stator is provided with a suitable lead line *b***1'**, *b***2'**, *b***3'**, *b***4'**, etc. respectively which engage the autotransformer at spaced distances in such a manner that each of the contacts adds a total of one volt through its associated line from the autotransformer. A fixed voltage Z is always in circuit and this may be adjusted as desired. As heretofore explained, the major and minor stators are provided with rotors **69** and **70** respectively which selectively engage the various contacts of their respective stators. The central pivot of the major rotor **60** is connected to a work circuit **83** by means of line **84** while the central pivot of the minor rotor **61** is connected to

said work circuit 83 by means of line 85. It will be understood that the movement of rotor 69 from one contact to the adjacent contact of the major stator 60 has the same effect as a half revolution of the rotor 70 about the minor stator 61. Thus, in the position of FIG. 13 wherein rotor 69 is positioned on contact *a*2 a total of four volts (added to Z) would be flowing through the major stator to the work circuit 83 and an additional two volts would be flowing through the minor stator 61 since rotor 70 is positioned in engagement with contact *b*3. The four volts flowing through line 84 to the work circuit in addition to the two volts flowing through line 85 to the work circuit equals six volts (plus Z), being transferred to the work circuit by means of the major and minor stators. It will thus be understood that through the mechanical means heretofore described, advancing the rotor 70 and associated arms 77 and 78 and portions 77*a* and 78*a* of the minor stator in a counterclockwise direction to *a*6 contact, as viewed in FIGS. 10 and 13, causes the rotor 69 of the major stator to be driven in a clockwise direction so that the rotor of the major stator moves to the next contact and thereby adds four volts.

Referring again to FIGS. 10 and 11, the rotor 70 of the minor stator is in engagement with contact *b*1 as seen in FIG. 11 while the rotor 69 of the major stator is in engagement with its contact number *a*1 as seen in FIG. 10. As the rotor 70 of the minor stator is caused to rotate in a clockwise direction, as viewed in FIG. 11, it will move to the position where it is in engagement with contact number *b*5 before its outstanding portions 77*a* and 78*a* engage the outstanding portions 75*a* and 76*a* of the major stator. Upon further clockwise rotation of the rotor of the minor stator the rotor of the major stator will be advanced one contact for each contact advanced by the rotor of the minor stator. It will be remembered that the rotor of the minor stator gains one volt as it advances from one contact to another while the rotor of the major stator gains four volts as it advances from one contact to another in this direction. It will be understood that regardless of the positioning of the rotor of the major stator, it is always possible to rotate the rotor 70 of the minor stator in a counterclockwise direction and thereby reduce up to a total of four volts from that already flowing, if the minor rotor has been advanced at least five contacts from the setting of FIGS. 10 and 11. Thus, it will be seen that from an initial setting, as seen in FIGS. 10 and 11, the rotor of the minor stator must advance across five contacts prior to engaging and advancing the rotor of the major stator. Since the rotor of the major stator is always in engagement with one of its contacts, any advancement of the rotor of the minor stator is in addition to the voltage of that major step, so that as the minor rotor is rotated in a clockwise direction as seen in FIG. 10, the total voltage from the switches advances from a total of zero volts flowing to the major stator to one, two, three and four as the minor rotor is advanced until the portion 78*a* of the minor stator engages portion 75*a* of the mapor stator; thereafter the major rotor is advanced along with the minor rotor so that an additional four volts flow from the major stator and an additional one volt flows from the rotor of the minor stator for each additional contact traversed. From any setting it is possible to add or subtract four volts by rotating the rotor of the minor stator in a clockwise or counterclockwise direction respectively without affecting the setting of the major rotor. The above voltage from the switch are in addition to the minimum transformer voltage Z.

In FIGS.14 through 19 we have shown still another embodiment of the present invention. The present embodiment is somewhat similar to that shown in FIG. 9 with the exception of the minor stator which instead of being fixed, as in FIG. 9, is mounted for rotation relative to its supporting member under certain circumstances. Here again, a pair of spaced major and minor insulating stators 90 and 91 respectively are supported within a U-shaped bracket 92, having upstanding end portions 93 and 94. The major stator, rigid with bracket 92, is shown provided with a plurality of six circumferentially spaced contacts *c*1, *c*2, *c*3, *c*4, etc, as seen in FIG. 15. The minor stator is provided with a plurality of five contacts *d*1, *d*2, *d*3, *d*4 and *d*5 spaced about a portion of the circumference of the stator. The minor stator is provided with a pair of outstanding lugs 95 and 96 which are spaced 180 degrees apart on the outer circumference of said stator. The entire minor stator is secured to the radially extending flange portion 97*a* of a hollow cylindrical member 97, by means of screws 98. The cylindrical portion of member 97 is contained within the bore of a hollow annular housing 99 which in turn is rigidly secured to the upstanding end 94 of bracket 92 by means of screws 100. The cylindrical member 97 is provided with a hollow sleeve member 101 which embraces its outer surface. The sleeve member 101 is provided with a plurality of elongated longitudinally extending grooves 102 which are spaced circumferentially about its outer surface. The grooves 102 are adapted to receive balls 103 contained in bores 104 of the surrounding housing 99. The sleeve member 101 and member 97 are maintained against axial movement in housing 99 by O-rings 141. The balls are spring loaded by means of coil springs 105 which are in turn retained by screws 106. The purpose of the balls is to engage the grooves 102 of the sleeve 101 and retain the cylindrical member 97 and associated minor stator 91 against accidental rotation in housing 99. The balls and springs 105 are of such size that a predetermined force will overcome the force of the springs and cause the balls to be retracted into the bores 104 and permit the rotation of the minor stator within the housing 99. A control knob 103 is connected directly to the rotor 105 of the minor stator 91 by means of a centrally located drive shaft 106 which extends through the hollow of the cylindrical member 97. It will be understood that the driving arms associated with the major and minor stators and their associated rotor construction is identical to that previously described with regard to FIG. 9. The major stator 90 is rigidly secured to the upstanding end portion 93 of the bracket by means of screws 107.

Referring now to FIGS. 15 and 16, it will be seen that the rotor 108 of the major stator is in engagement with contact *c*1 of the major stator, as seen in FIG. 15 and the rotor 109 of minor stator 91 is in engagement with contact *d*1 of the minor stator, as seen in FIG. 16. The rotor 108 is limited to further counterclockwise movement by stop 140. Upon clockwise rotation of the rotor 109 of the minor stator, it will advance across five contacts before its associated longitudinally extending members 110 and 111 engage the members 112 and 113 of the rotor of the major stator in driving relationship as seen in FIG. 18 to advance the rotor 108 of the major stator into engagement with contact *c*2. At the time the members 110 and 111 of the minor stator engage the members 112 and 113 of the major stator, the rotor 109 of the minor stator simultaneously engages the upper projecting lug 95 as seen in FIG. 19 and causes the entire minor stator to be rotated (overcoming detents 102, 103) within the housing 99 from the position shown in FIG. 16 to that shown in FIG. 19. It will be understood that if the control knob 103 is continued to be turned so that rotor 109 is moved in a clockwise direction, each movement of the rotor of the major stator from one contact to the next necessitates that the entire minor stator be rotated. Upon rotation of the minor stator, balls 103 are caused to index with the various grooves 108 in sleeve 101. It will be understood that the grooves 102 are spaced a circumferential distance about sleeve 101, equal to the circumferential spacing of the contacts of the major stator, so that the grooves 102 will index with the balls 103 at the same time that the rotor 108

of the major stator engages its respective contacts. Thus, the entire minor stator will have different positions for each step selected on the major stator. Each voltage step on the major stator equals $n-1$ times each voltage step on the minor stator where $n$ is the number of steps on the minor stator. In this case assume 5 steps on the minor stator of 2 volts each. Then each step on the major stator is 8 volts which equals (5—1) times 2 volts. In this construction of the present embodiment a fewer number of contacts are required on the minor stator than in FIG. 9 and the construction of said stator is thereby somewhat simplified. Comparing FIGS. 15 and 19 it is seen that the entire minor stator has been revolved in a clockwise direction from that of FIG. 16 to that of FIG. 19 as illustrated most clearly by the relative positions of the lugs **95** and **96**. Upon reverse or counterclockwise rotation the rotor **109** of the minor stator, as seen in FIG. 19, ceases to engage the lug **95** of minor stator **91** and thereby permits engagement of the various contacts of the minor stator in a counterclockwise direction so that the members **110** and **111** of the minor stator rotate through approximately 180 degrees before again engaging the members **112** and **113** of the major stator, as seen in FIG. 15. This engagement occurs simultaneously with the engagement of the rotor **109** of the minor stator with the lower lug **96**, as seen in FIG. 16, of the minor stator whereby the rotor **108** of the major stator is moved in a counterclockwise direction while the entire minor stator is rotated within the housing **99** back to the position of FIG. 15 wherein stop **140** limits further movement. Fixed on shaft **105** is spring arm **127**, analogous to arms **71** and **72** of FIG. 9, which engages detent grooves in stop plate **128** for each contact position of rotor **109**. The force for moving arm **127** out of detent **128** is insufficient to overcome detents **102**, **103**. Thus, only for each movement of the major rotor from one contact to another, is the entire minor stator caused to index. This particular form of the invention requires fewer switch contacts and transformer taps than in the secondly described device and still gives the same number of selection steps.

Referring now to FIG. 20 wherein I have shown a wiring diagram which relates specifically to the embodiment of the present invention shown in FIGS. 14 through 19. An autotransformer **120** is connected to a suitable power source by lines **121** and **122**. The major stator **90** is provided with six contacts *c1*, *c2*, *c3*, *c4*, etc., each of which is a major voltage selection step of say five volt multiples. Each of the six contacts has a lead wire *c1'*, *c2'*, *c3'*, etc. associated therewith. Each lead wire is tapped into the autotransformer at suitable spaced distances whereby each adds five volts. The minor stator **91** has five contacts *d1*, *d2*, *d3*, *d4* and *d5*, which are minor voltage selection steps of say one volt multiples. The contacts of minor stator **91** are also provided with a suitable number of lead lines *d1'*, *d2'*, *d3'*, *d4'* and *d5'* each respectively connecting its associated contact with the autotransformer at spaced distances equal to say one volt intervals. Both the major and minor rotors **90** and **91** respectively are connected by suitable lines **124** and **125** respectively to a work circuit **126**. It will be understood that the movement of rotor **108** from one contact to the adjacent contact on the major stator **90** exceeds by the value of one minor step the movement of the rotor **109** of the minor stator across all five of its contacts. Thus, the rotor positions seen in FIG. 20 wherein the rotor **108** positioned on contact *c2* supplies a total of five volts through the major stator to the work circuit (plus voltage X). An additional four volts is supplied through the minor stator **91** since the rotor **109** is positioned in engagement with the contact *d5*. This would account for nine volts being transferred to the work circuit **126** through the major and minor rotors **108** and **109** respectively. This voltage is in addition to the constant voltage across X which may, of course, be set at any desired amount.

In view of the foregoing description, taken in conjunction with the accompanying drawing, it is believed that a clear understanding of the construction, operation and advantages of the device will be quite apparent to those skilled in this art.

Having thus described our invention and illustrated its use, what I claim is new and desire to secure by Letters Patent is:

1. An electrical switch for uniformly increasing or decreasing the amount of voltage flowing therethrough, said switch comprising a stator, a plurality of electrical contacts arcuately spaced about said stator, a rotor contact pivotally mounted centrally of said stator for movement selectively into engagement with said spaced contacts, driving means, said driving means driving suitable driven means, said driving means including a ratchet wheel, said driven means including a pair of opposed pawls, said pawls being pivotally secured to suitable mounting means, said mounting means in operative driving engagement with said rotor contact, said pawls operatively engaging said ratchet wheel, said pawls being disposed so that when one is being driven by the ratchet wheel the other passively follows, whereby to permit driving of said mounting means in either direction upon rotation of said ratchet wheel in either direction, and means disposed adjacent said ratchet wheel for disengaging a driving pawl at a particular point of operation.

2. An electrical switch for uniformly increasing and decreasing the amount of voltage flowing therethrough, said switch comprising a stator and a rotor, said stator having a plurality of circumferentially spaced contacts, said rotor having a contact for selective engagement with the contacts of said stator, driving means for rotating said rotor, driven means operatively associated with said rotor, said driven means including a pawl disposed to drive when driven in one direction and to passively follow when driven in the other direction, a second pawl opposed to said first pawl and disposed to drive when said first pawl follows and follow when said first pawl drives, whereby said rotor may be driven in either direction, and means disengaging the driving pawl at a particular point of rotation.

3. A rotary switch comprising a pair of spaced stators, each of said stators being provided with a plurality of circumferentially spaced contacts, a rotor rotatably mounted to each of said stators, driving means associated with said switch, said driving means causing one of said rotors to rotate about a first of said stators, the other of said rotors being secured to a support bracket, said support bracket rotatably secured to the second of said stators, pawl means pivotally secured to said support bracket, a ratchet wheel associated with said driving means, resilient means urging said pawl means into driving engagement with said ratchet wheel, said pawl means being disposed so as to engage said ratchet wheel upon rotation of said ratchet wheel in either direction.

4. A rotary switch comprisng a pair of spaced stators, each of said stators being provided with a plurality of circumferentially spaced contacts, a rotor rotatably mounted to each of said stators, driving means associated with said switch, said driving means causing one of said rotors to rotate about a first of said stators, the other of said rotors being secured to a support bracket, said support bracket rotatably secured to the second of said stators, opposed pawls pivotally secured to said support bracket, a ratchet wheel associated with said driving means, resilient means uring said opposed pawls into driving engagement with said ratchet wheel, said opposed pawls being disposed so that when one is being driven by the ratchet wheel the other passively follows, thereby permitting driving the pawls upon rotation of said ratchet wheel in either direction and means disposed adjacent said ratchet wheel for disengaging the driven pawl from said ratchet wheel.

5. A rotary switch comprising a pair of spaced stators,

each of said stators being provided with a plurality of circumferentially spaced contacts, a rotor rotatably mounted to each of said stators, driving means associated with said switch, said driving means causing one of said rotors to rotate about a first of said stators, the other of said rotors being secured to a support bracket, said support bracket rotatably secured to the second of said stators, a pair of right and left dogs pivotally secured to said support bracket, a ratchet wheel associated with said driving means, resilient means urging said dogs into driving engagement with said ratchet wheel, said dogs being disposed so that when one is being driven by the ratchet wheel the other passively follows, thereby permitting driving the dogs upon rotation of said ratchet wheel in either direction and means disposed adjacent said ratchet wheel for disengaging the driven dog from said ratchet wheel.

6. A rotary switch comprising a pair of spaced concentric stators, each of said stators being provided with a plurality of circumferentially spaced electrical contacts, a pair of rotors rotatably mounted one on each of said stators, each of said rotors having an electrical contact movable by rotor rotation selectively into engagement with the spaced contacts of its associated stator, a first of said rotors having an axially outstanding pin portion, driving means associated with said switch, said driving means engaging said outstanding pin portion and causing said first rotor to rotate about its associated stator, the second of said rotors being secured to a support bracket, said support bracket rotatably secured to a second one of said stators, a ratchet wheel associated with said driving means, a pair of right- and left-hand drive dogs pivotally secured to said support bracket in position to engage said ratchet wheel, resilient means urging said dogs into driven engagement with said ratchet wheel, said dogs being disposed so that when one is being driven by the ratchet wheel the other passively follows, thereby permitting driving one or the other of said dogs upon rotation of said ratchet wheel in either direction, and means disposed adjacent said ratchet wheel for disengaging the driven dog from said ratchet wheel whenever said driving means engages said projecting pin.

7. A rotary electrical switch for controlling the amount of voltage flowing therethrough, said switch comprising a pair of spaced stators, each of said stators having a plurality of contacts thereon, a first rotor rotatably secured to a first of said stators and adapted to selectively engage the contacts of said first stator, driving means causing said first rotor to rotate, a pair of opposed pawls adapted to alternately engage said driving engagement in driven engagement, support means retaining said pawls, said support means rotatably secured to the second of said stators, a second rotor contact secured to said support means and adapted to selectively engage the contacts of said second stator, said pawls being disposed so that when one is being driven by said driving means the other passively follows, thereby permitting driving said second rotor in either direction.

8. A rotary electrical switch for controlling the amount of voltage flowing therethrough, said switch comprising a drive shaft, said drive shaft having a driving gear mounted thereon, a pair of spaced stators, each of said stators having a plurality of contacts thereon, a driven shaft supported between said stators, a driven gear rigidly secured to said driven shaft, said driven gear engaging said driving gear, a first rotor rotatably secured to said first stator and adapted to selectively engage the contacts of said first stator, said driven gear engaging said rotor and causing said first rotor to rotate, a ratchet wheel secured to said driven shaft, a pair of opposed pawls adapted to alternately engage said ratchet wheel, support means retaining said pawls, said support means rotatably secured to the second of said stators, a second rotor frictionally engaging said support means and adapted to selectively engage upon rotation the contacts of said second stator, said pawls being disposed so that when one is being driven by said ratchet wheel the other passively follows, thereby permitting driving said support means and second rotor upon rotation of said ratchet wheel in either direction.

9. A rotary electrical switch for controlling the amount of voltage flowing therethrough, said switch comprising a drive shaft, said drive shaft having a control knob and a driving gear mounted thereon, a pair of spaced stators positioned adjacent said drive shaft, each of said stators having a plurality of contacts thereon, a driven shaft associated with the first of said stators, a driven gear rigidly secured to said driven shaft, said driven gear in meshing engagement with said driving gear, a first rotor contact rotatably secured to said first stator and adapted to selectively engage the contacts of said first stator, a projecting pin provided on said first rotor, a projecting pin provided on said driven gear, said arm and pin being located in the same circumferential path of travel and engaging one another upon rotation of said driven gear, said driven gear thereby causing said first rotor to rotate, a ratchet wheel rigidly secured to said driven shaft, a pair of opposed pawls adapted to alternately engage said ratchet wheel in driven engagement, support means pivotally retaining said pawls, said support means rotatably secured to the second of said stators, a second rotor contact frictionally engaging said support means and adapted to selectively engage upon rotation the contacts of said second stator, said pawls being disposed so that when one is being driven by said ratchet wheel the other passively follows, thereby permitting driving said support means and second rotor upon rotation of said ratchet wheel in either direction and means disposed adjacent said ratchet wheel for disengaging the driven pawl from said ratchet wheel whenever said projecting pin and arm engage each other.

10. An electrical rotary switch comprising a pair of spaced concentric stators, a support bracket, the first of said stators being a major stator mounted stationary upon said support bracket, the second of said stators being a minor stator and mounted for independent rotation on said support bracket, said major stator having a plurality of spaced contacts arranged about its entire circumference, said minor stator having a plurality of spaced contacts arranged about a portion of its circumference, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating one of said rotor contactors about its associated stator, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arm of said rotors adapted to engage and drive one another in either direction during rotation and means on said minor stator whereby said minor stator is rotated within its supporting bracket upon selective movement of the rotor contactor on said major stator from one contact to another, said means so positioned on said minor stator to permit engagement of the rotor contactor of said minor stator with each of its associated contacts prior to movement of the rotor contactor of the major stator in another direction.

11. The combination of claim 10 including resilient detent means for releasably holding said minor rotor contactor in position engaging each of said minor stator contacts, releasable detent means for holding said minor stator in various indexed positions relative to its supporting bracket, and the holding power of said first named detent means being less than the holding power of said last named detent means.

12. An electrical rotary switch comprising a pair of spaced concentric stators, a support bracket, the first of said stators mounted stationary upon said support bracket, the second of said stators mounted for independent rotation on said support bracket, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts arranged about its circumference, a rotor contactor mounted for rotation on each of said stators selec-

tively into engagement with said spaced contacts, driving means for rotating one of said rotor contactors about its associated stator, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arms of said rotors adapted to engage and drive one another in either direction during rotation, and means whereby said second stator is rotated within its supporting bracket upon selective movement of the rotor contactors on said first stator from one contact to another, said means permitting engagement of the rotor contact of said second stator with each of its associated contacts prior to movement of the rotor contactors of said first stator in another direction.

13. An electrical rotary switch comprising a pair of spaced concentric stators, the first of said stators being stationary, the second of said stators being mounted for independent rotation, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said spaced contacts, driving means for rotating one of said rotor contactors about its associated stator, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arms of said rotors adapted to engage and drive one another in either direction during rotation and means whereby said second stator is rotated within its supporting bracket upon selective movement of the rotor contactor on said first stator from one contact to another, said means permitting engagement of the rotor contactor of said second stator with each of its associated contacts prior to movement of the rotor contactor of said first stator in another direction.

14. An electrical rotary switch comprising a pair of spaced concentric stators, a support bracket, the first of said stators mounted stationary upon said support bracket, the second of said stators mounted for independent rotation on said support bracket, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts arranged about its circumference, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating one of said rotor contactors about its associated stator, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arms of said rotors adapted to engage and drive one another in either direction during rotation and means whereby said second stator is rotated within its supporting bracket upon selective movement of the rotor contactor on said first stator from one contact to another, said means permitting engagement of the rotor contactor of said second stator with each of its associated contacts prior to movement of the rotor contactor of said first stator in another direction.

15. An electrical rotary switch comprising a pair of spaced concentric stators, the first of said stators being stationary, the second of said stators being mounted for independent rotation, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating one of said rotor contactors about its associated stator, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arms of said rotors adapted to engage and drive one another in either direction during rotation and means whereby said second stator is rotated within its supporting bracket upon selective movement of the rotor contactor on said first stator from one contact to another.

16. An electrical rotary switch comprising a pair of spaced concentric stators, the first of said stators being stationary, the second of said stators being mounted for independent rotation, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating said rotor contactors about their associated stators in either clockwise or counterclockwise direction, said driving means comprising a pair of outstanding radially spaced arms associated with each of said rotors, the arms of said rotors adapted to engage and drive one another in either direction during rotation, and means rotating said second stator on said support bracket upon selective movement of the rotor contactor on said first stator from one contactor to another, said means permitting engagement of the rotor contactor of said second stator with each of its associated contacts prior to movement of the rotor contactor of said first stator in another direction.

17. An electrical rotary switch comprising a pair of spaced concentric stators, a support bracket, the first of said stators mounted stationary upon said support bracket, the second of said stators mounted for independent rotation on said support bracket, said first stator having a plurality of spaced contacts arranged about its circumference, said second stator having a plurality of spaced contacts arranged about its circumference, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating said rotor contactors about their associated stators in either clockwise or counterclockwise direction, said driving means comprising a pair of outstanding radially spaced arms associated with each of said rotors, the arms of said rotors adapted to engage and drive one another in either direction during rotation, and means rotating said second stator on said support bracket upon selective movement of the rotor contactor on said first stator from one contact to another, said means permitting engagement of the rotor contactor of said second stator with each of its associated contacts prior to movement of the rotor contactor of said first stator in another direction.

18. An electrical rotary switch comprising a pair of spaced concentric stators, the first of said stators having a plurality of spaced contacts arranged about its entire circumference, the second of said stators having spaced contacts arranged about only a portion of its circumference, said second stator mounted for rotation in a supporting bracket, a rotor contactor mounted for rotation on each of said stators selectively into engagement with said associated spaced contacts, driving means for rotating one of said rotor contactors, each of said rotors having a pair of outstanding radially spaced arms associated therewith, the arms of said rotors adapted to engage and drive one another in either direction during rotation and means associated between said stators whereby said second stator is rotated within its supporting bracket upon selective movement of the rotor contactor on said first stator from one contact to another.

19. An electrical rotary switch comprising a frame mounting at least a pair of stators in predetermined spaced relation, each of said stators being provided with a plurality of circumferentially spaced stationary contacts, one of said stators having contacts connected for equal minor voltage selection steps, the other of said stators having contacts connected for equal major voltage selection steps, a rotor rotatably mounted adjacent each of said stators and having at least one contact thereon for selectively engaging with the stationary contacts on the stator associated therewith, a shaft operatively connected with said one of said rotors, means for rotatably driving said shaft and said one rotor, and a connection between said rotors permitting a rotating movement of said one rotor to continuously drive said other of said rotors and carry the contact of the latter into engagement with any one of the contacts on the stator associated therewith,

said connection also permitting said one rotor to be rotated independently of said other rotor after said other rotor is positioned to engagement with said any one of the contacts on the associated stator so as to carry the contact on the said one rotor into preselected engagement with the contacts on the stator associated with the same.

20. An electrical rotary switch as defined in claim 19 and wherein the connection between said rotor includes means effective to limit the independent movement of the said one rotor corresponding to the position occupied by the said other rotor.

21. An electrical rotary switch as defined in claim 19 and wherein the connection between said rotors is operative to permit a rotatable movement of said one rotor in one direction to drive the other of said rotors in the same direction, said connection also permitting said one rotor to be rotated in the opposite direction independently of said other rotor.

22. An electrical rotary switch as defined in claim 21 and wherein said connection is further characterized by having means operative to limit the oppositely directed movement of said one rotor correspondingly to the position occupied by the said other rotor.

23. An electrical rotary switch comprising a frame mounting at least a pair of stators in predetermined spaced relation, each of said stators being provided with a plurality of circumferentially spaced stationary contacts, a rotor rotatably mounted adjacent each of said stators and having at least one contact thereon for selectively engaging with the stationary contacts on the stator associated therewith, a shaft operatively connected with one of said rotors, means for rotatably driving said shaft and said one rotor, and a connection between said rotors comprising at least one arm operatively connected with each of said rotors being drivingly engageable one with the other in response to a rotatable movement of said one rotor effective to drive the other of said rotors and carry the contact of the latter into engagement with a preselected one of the contacts on the stator associated therewith, said connection also permitting said one rotor to be rotated independently of said other rotor as to carry the contact on the former into preselected engagement with the contacts on the stator associated with the same.

24. An electrical rotary switch comprising a frame mounting at least a pair of stators in predetermined spaced relation, each of said stators being provided with a plurality of circumferentially spaced stationary contacts, a rotor rotatably mounted adjacent each of said stators and having at least one contact thereon for selectively engaging with the stationary contacts on the stator associated therewith, a shaft operatively connected with one of said rotors, means for rotatably driving said shaft and said one rotor, and a connection between said rotors comprising a pair of arms on each of said rotors being drivingly engageable with each other in response to a rotatable movement of said one rotor in one direction to drive the other of said rotors in the same direction and carry the contact of the latter into engagement with a preselected one of the contacts on the stator associated therewith, said arms being disengageable in response to a rotatable movement of said one rotor in the opposite direction effective to permit an independent movement of the latter to carry its contact into preselected engagement with the contacts on the stator associated with the same.

25. An electrical rotary switch as defined in claim 24 and wherein said arms are moved into re-engagement with each other in response to a predetermined movement of said one rotor in the opposite direction and effective to cause the rotatable actuation of said other rotor in said latter direction.

26. A rotary switch comprising a pair of spaced stators, each of said stators being provided with a plurality of circumferentially spaced contacts, a first of said stators having contacts connected for equal minor voltage selection steps, the second of said stators having contacts connected for equal major voltage selection steps, a rotor rotatably mounted concentric to each of said stators, each of said rotors having at least one contact thereon for selectively engaging with the stationary contacts of the stator associated therewith, driving means associated with said rotors and including a connection between said rotors permitting a rotating movement of the first rotor to continuously drive the second rotor and carry the contact of said second rotor into engagement with any one of the contacts on the stator associated therewith, said connection also permitting the first rotor to be rotated independently of said second rotor after the second rotor is positioned to said any one of the contacts on the secondary stator so as to carry the contact of said first rotor into pre-selected engagement with the contacts on the stator associated with the same.

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