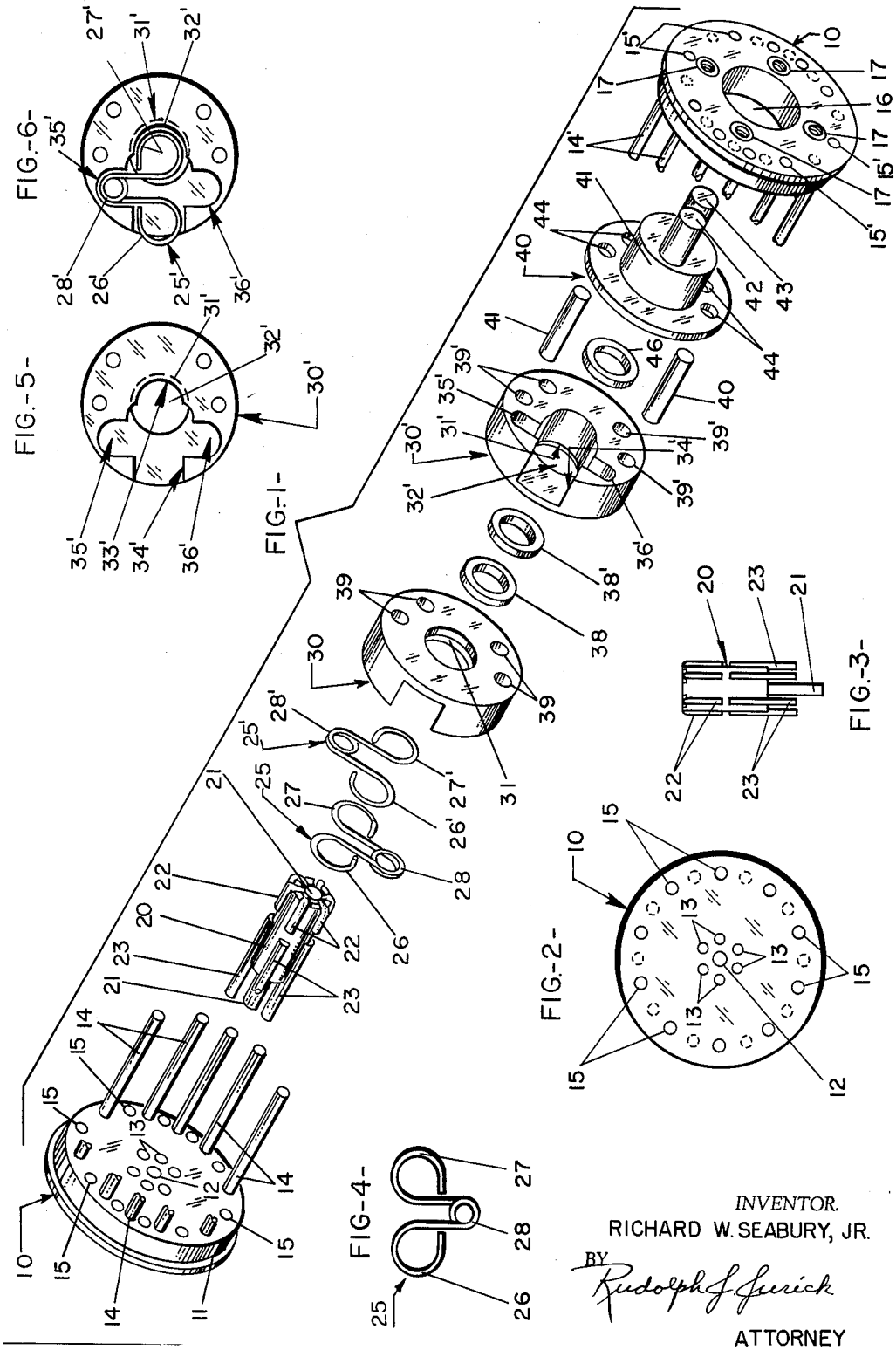
Dec. 28, 1965 R. W. SEABURY, JR 3,226,496

ROTARY ELECTRICAL SWITCH WITH IMPROVED SPRING CONTACT AND ROTOR STRUCTURE

Filed Sept. 15, 1964

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

FIG.-7-

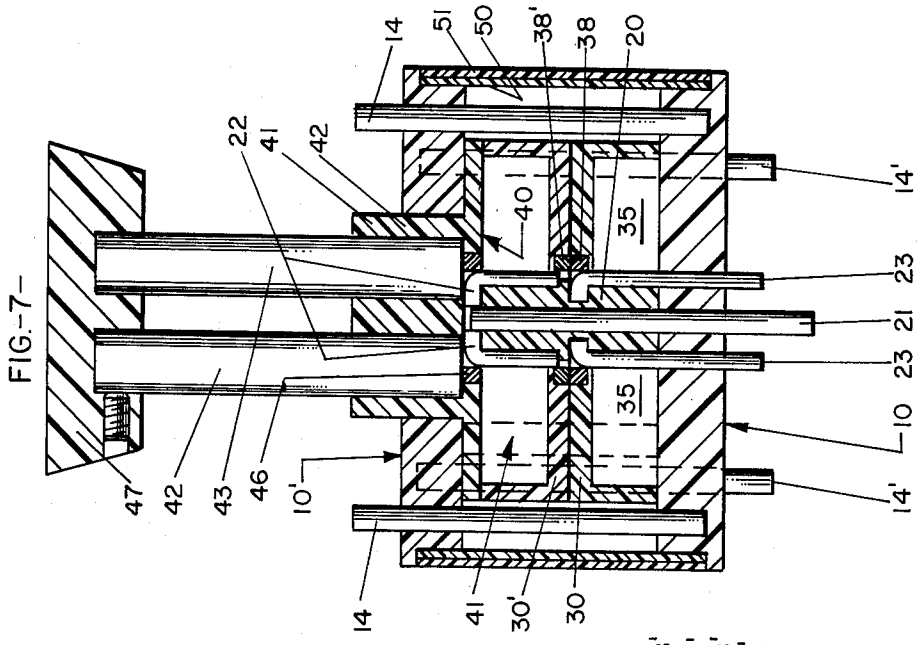


FIG.-8-

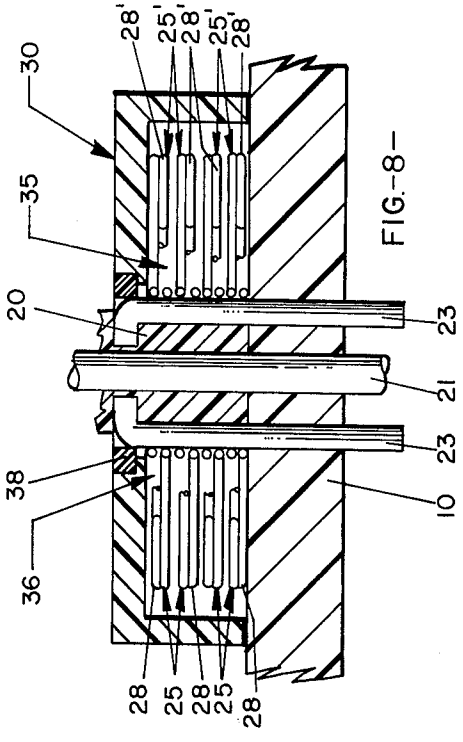
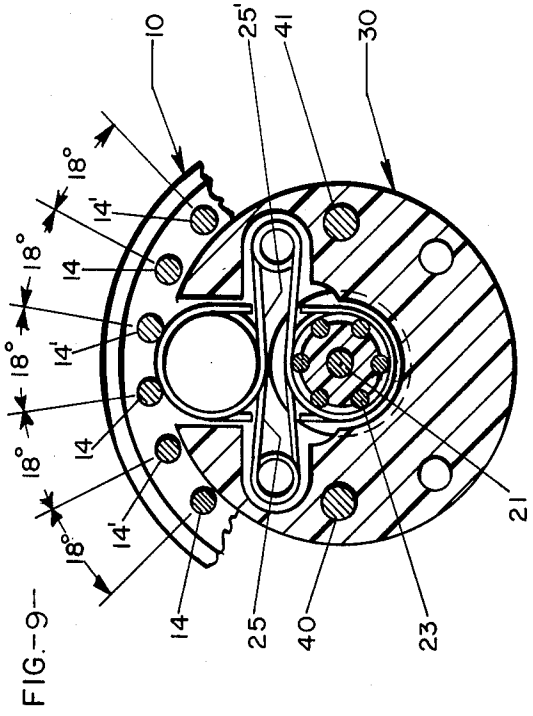


FIG.-9-



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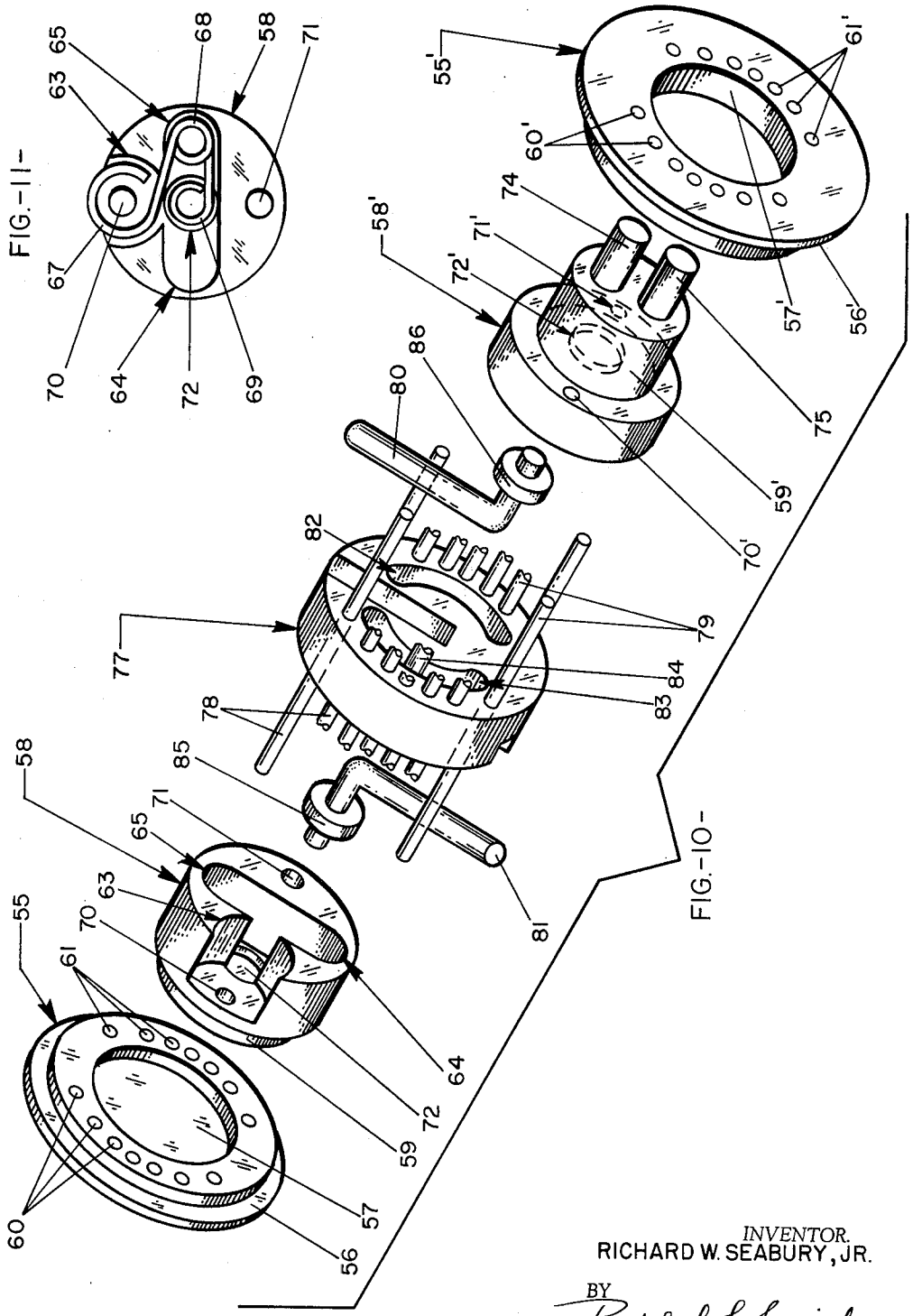
Filed Sept. 15, 1964

4 Sheets-Sheet 3

FIG.-11-

FIG.-10-



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4 Sheets-Sheet 4

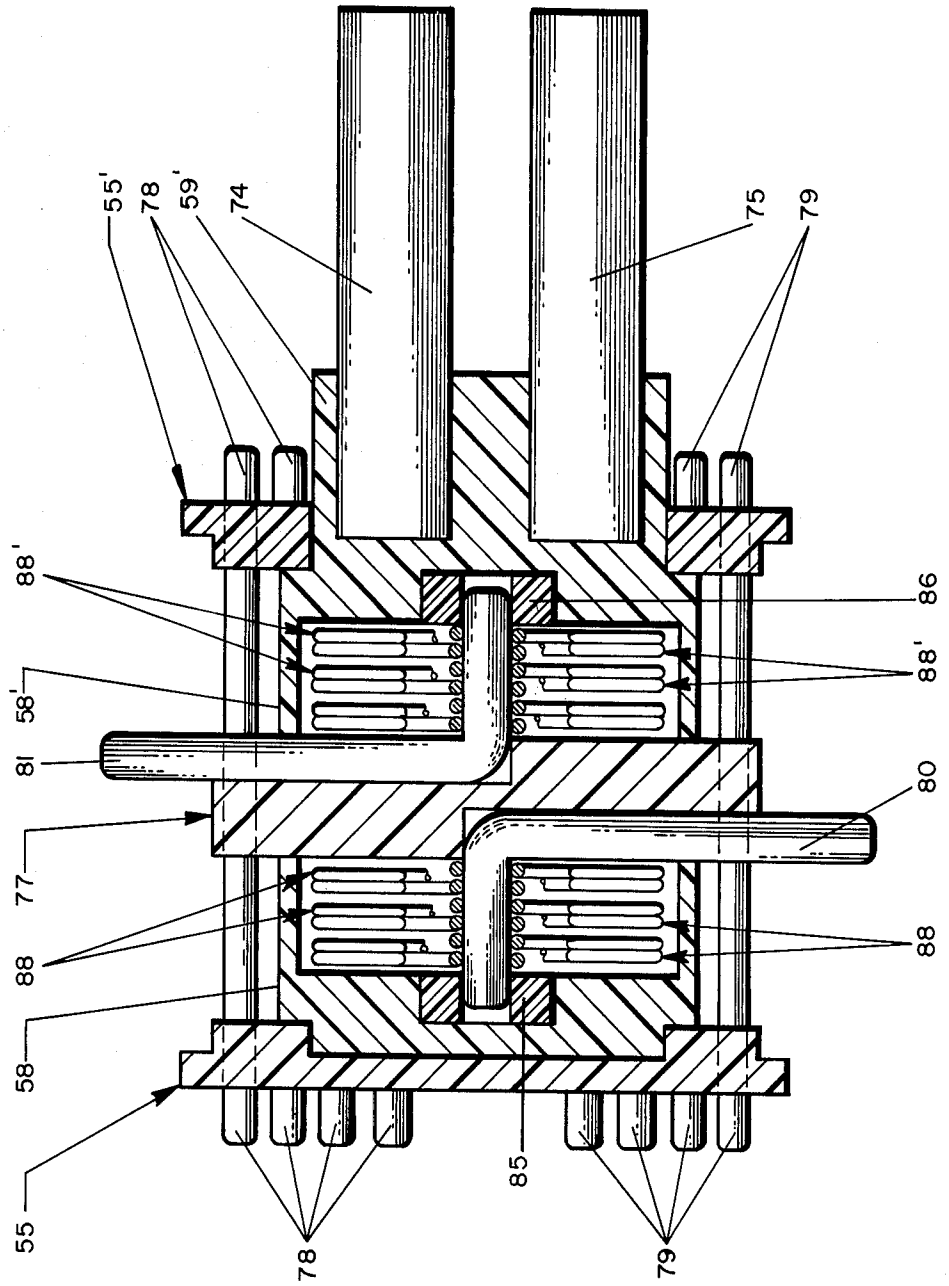

FIG.-12-

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ROTARY ELECTRICAL SWITCH WITH IMPROVED SPRING CONTACT AND ROTOR STRUCTURE

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14 Claims. (Cl. 200—11)

This invention relates to electrical switches and more particularly to a multi-point rotary electrical switch of novel construction having improved operating characteristics and a long operating life.

Rotary electrical switches of the class to which this invention is directed comprise a plurality of arcuately-spaced fixed contacts and one or more rotatable common contacts arranged to engage the fixed contacts in a step-by-step manner. In many applications, it is essential that the contacts of the switch have a negligible and constant ohmic resistance and a low thermal coefficient. Also, the switch should be of rugged construction, have a high current-carrying capacity and be adapted for use in relatively high voltage circuits with complete safety to the operator. Additionally, the switch should be so constructed as to permit the soldering thereto of heavy connection leads, or cables, with a minimum possibility of damage occurring during the soldering operation. The above-stated requirements are particularly pertinent to a switch for use in calibrating apparatus designed for calibrating and/or checking electrical indicating instruments, or the like.

A rotary switch made in accordance with this invention provides the above-mentioned, and other, features and characteristics.

An object of this invention is the provision of a high quality, multi-point rotary switch of rugged construction.

An object of this invention is the provision of a multi-point rotary switch of relatively small size, which switch has a low ohmic contact resistance, a high current-carrying capacity and a high voltage insulation between the metal contacts thereof.

An object of this invention is the provision of a rotary switch having a low, constant ohmic contact resistance whereby the switch is particularly adapted for use in low-voltage circuits of precise measuring apparatus.

An object of this invention is the provision of a multi-point rotary switch wherein the fixed contacts comprise metal rods, which rods also constitute the terminals by means of which the switch is connectable into an electrical circuit.

An object of this invention is the provision of a multi-point rotary switch wherein electrical continuity between a common contact and a selected one of a plurality of fixed contacts is effected by a plurality of flexible contact springs carried by a rotor member.

An object of this invention is the provision of a multi-point rotary switch comprising a plurality of arcuately-spaced metal rods carried by a pair of spaced end plates, a rotatable rotor member, a plurality of contact springs carried by the rotor member and having portions extending radially therefrom for engagement with a selected one of the rods, and a pair of insulator rods extending axially of the rotor member to effect rotation of the rotor member relative to the rods.

An object of this invention is the provision of a double-pole, multi-point rotary switch comprising a plurality of arcuately-spaced, parallel stationary contacts spaced equally from a center axis, fixed, axially-spaced contact means concentric with respect to the said axis, a pair of rotor members rotatable about the said axis, the one rotor member carrying flexible contact springs providing electrical continuity between the stationary contacts and one of the axially-spaced contact means, and the other rotor member carrying flexible contact springs providing electrical continuity between the stationary contacts and the other of the axially-spaced contact means.

These and other objects and advantages of the invention will become apparent from the following description when taken with the accompanying drawings. It will be understood, however, that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the claims appended hereto.

In the drawings wherein like reference characters denote like parts in the several views:

FIGURE 1 is an exploded, isometric view showing the components of a double pole rotary switch made in accordance with one embodiment of this invention;

FIGURE 2 is a bottom plan view of the lower end plate;

FIGURE 3 is an elevational view of the center post carrying the common contacts;

FIGURE 4 is a plan view of one of the contact springs carried by the rotor members;

FIGURE 5 is a plan view of one of the rotor members;

FIGURE 6 is similar to FIGURE 5 and showing one of the contact springs disposed within the cavity of the rotor member;

FIGURE 7 is, essentially, an enlarged, central cross-sectional view of the assembled switch with the contact springs omitted;

FIGURE 8 is a similar, fragmentary view, drawn to a still larger scale and showing the orientation of the contact springs carried by the lower rotor member;

FIGURE 9 is an enlarged fragmentary plan view showing the lower stator member positioned so that the projecting portions of the contact spring loops lie between adjacent, stationary contacts carried by the two end plates;

FIGURE 10 is an exploded, isometric view showing the components of a two-pole seven position switch made in accordance with another embodiment of this invention;

FIGURE 11 is a top plan view of the lower rotor member with one of the wire contact springs disposed in a deep cavity formed therein, and

FIGURE 12 is, essentially, a vertical, central, cross-sectional view drawn to an enlarged scale and showing the assembled switch having the components shown in FIGURES 10 and 11.

Reference now is made to the exploded view of FIGURE 1, showing the components which go to make up a double-pole, ten point rotary switch. The numeral **10**, identifies a lower end plate, or stator plate, preferably made of a silicone-asbestos compound having a high dielectric strength, a low moisture absorption factor, and capable of withstanding the high temperature for soldering heavy connection cables to the switch. The plate **10** includes an integral shoulder **11**, a central hole **12** and a circular array of six (6) holes **13**. A plurality of longitudinally-extending metal rods **14** have ends force-fitted into and bottomed in appropriate bores formed along the periphery of the end plate, said rods being of equal length. Passing completely through the end plate are a plurality of holes **15**, see also FIGURE 2, which is a bottom plan view of the end plate. The holes **15** and the bores for the rods **14** are spaced apart equally and lie on a common circle. In the particular switch illustrated, there are ten of the rods **14**, and ten of the holes **15**, whereby the angularly separation of adjacent holes and rods equals 18 degrees.

The complementary upper end plate **10'** also is provided with a similar arrangement of rods **14'** and holes **15'**. In this case, the rods **14'** are force-fitted into and bottomed in bores equally spaced from the through holes **15'**. In the assembled switch, the free ends of the rods **14'** are pressed through the holes **15**, of the lower end plate **10**, and project therefrom, whereas the free ends of the rods **14** are similarly pressed through the holes **15'** of the upper end plate **10'** and project therefrom. It is here pointed out that the rods constitute the fixed contacts of the switch. The upper end plate **10'** is provided with an axial hole **16** and carries four threaded inserts **17** by means of which the assembled switch is mounted on a panel.

A center post **20**, preferably made of the same material as the two end plates, is provided with an axial hole into which a metal rod **21** is force-fitted, see also the elevational view thereof shown in FIGURE 3. Formed in the peripheral surface of this post are six aligned, but spaced, semi-circular grooves which communicate with an axial bore formed at the right end, as viewed in FIGURE 1. Disposed within these grooves are six wires **22**, which wires have ends offset at a right angle and soldered to the proximate end of the central rod **21**. These offset ends of the wires **22** lie within the said axial bore, whereby the radial surfaces of the wires lie somewhat below the end of the post. A second set of six wires **23** are disposed in the grooves at the other end of the post and have ends projecting therefrom. In the assembled switch, the end of the central rod **21** is force-fitted through the central hole **12** of the lower end plate **10** and the ends of the wires **23** are fitted through the corresponding holes **13**. Each of the stated ends project beyond the surface of the end plate whereby leads can be soldered thereto. It is here pointed out that the central rod **21** is electrically connected to the wires **22** and insulated from the wires **23**, and that all of the wires, as well as the central rod and the post, are carried in relatively fixed positions by the end plate **10**.

Electrical contact between the set of wires **22**, or the set of wires **23**, and the fixed contacts of the switch (comprising the rods **14** and **14'**) is made by a plurality of flexible, wire springs, only two such springs **25** and **25'** being shown in FIGURE 1. Each spring is formed of a single length of wire and all springs are of identical configuration, having large, substantially-closed end loops **26**, **27** and a central closed loop **28**, see also the elevational view of FIGURE 4. The end loop **26** has a diameter slightly less than the maxium diameter of the wire sets **22** and **23** carried by the center post **20**. Thus, when the loops **26** and **26'**, of the respective wire springs **25** and **25'**, are slidably inserted over the wires **22**, for example, these springs make good electrical contact with such wires and also are rotatable about the wires.

In FIGURE 1 are shown the two rotor members **30** and **30'**, preferably made of an acetal resin sold under the trademark Delrin, which material has a low temperature coefficient of expansion, a low moisture absorption, high dielectric strength and a constant coefficient of starting and running friction. The two rotor members are of identical construction but are reversely disposed, in axial alignment in the assembled switch. Referring specifically to the rotor member **30'**, which also is shown in the top plan view of FIGURE 5, such member is provided with a central bore **31'** communicating with a central hole **32'** of somewhat smaller diameter. Formed in the opposite face of the rotor member, is a deep cavity for accommodating a plurality of the wire springs **25**, **25'**. Such cavity includes an inner, circular portion **33'**, an outer, parallel wall portion **34'** extending to the peripheral surface of the rotor member, and intermediate laterally-extending portions **35'** and **36'**. The wire springs normally fit loosely within such cavity, as shown in the top plan view of FIGURE 6, wherein a spring **25'** is disposed in the cavity. The inner loop **27'**, of such spring, is generally concentric with the axial hole **32'**, the outer loop **26'** has a portion extending beyond the peripheral surface of the rotor member, and the intermediate, closed loop **28'** is disposed within the lateral portion **35'** of the deep cavity. The next wire spring placed into the cavity would have its large end loops overlying those of the bottom spring **25'**, but its center, closed loop would be disposed in the lateral portion **36'** of the cavity. In this way, a plurality of wire springs, for example, eight, can be positioned in the cavity with adjacent springs reversely oriented. Specifically, the odd numbered springs are positioned as shown in FIGURE 6, whereas the even numbered springs would have their intermediate, closed loops disposed in the cavity portion **36'**. With the intermediate, closed loops of all springs facing in the same direction, the adjacently-disposed end loops of all springs will lie in substantially abutting relation, as will be described in more detail hereinbelow.

The bores **31** and **31'**, formed in the bottom walls of the respective rotor members **30** and **30'**, see FIGURE 1, receive the respective bearing members **38**, **38'** made of a material sold under the trademark Teflon. Each of the rotor members **30** and **30'** is provided with the respective holes **39**, **39'** for receiving the plastic drive pins **40**, **41**, which pins serve to mechanically couple the rotor members together for rotation as a unit. It may here be pointed out that the rotor member **10** abuts against the inner surface of the end plate **10**, in the assembled switch, whereby the end plate serves to close the cavity of this rotor member. On the other hand, the cavity in the reversely-disposed rotor member **30'**, is closed by a cap **40** made of the same material as the rotor members and having an integral collar **41** provided with radially-spaced holes for receiving the ends of two plastic drive shafts **42** and **43**. The flange portion of the cap is provided with holes **44**, corresponding to the similar holes provided in the two rotor members, whereby the cap and rotor members are coupled together by the drive pins **40**, **41**. The collar **41** is designed to pass through the axial hole **16** of the upper end plate **10'** and serves a one bearing for the rotor members. A third washer **46**, similar to the washers **38**, **38'**, is positionable in an axial bore formed in the lower surface of the flange portion of the cap **40**. This washer, in the assembled switch, fits over the wires **22**, carried by the center post **20**, for purposes to be described hereinbelow.

Reference now is made to FIGURE 7, which is a central, cross-sectional view of the assembled switch, with the wire springs omitted. It will be noted that the fixed contact rods **14** are bottomed in the bores provided in the lower end plate **10**, with the oposite ends passing through the aligned holes formed in the upper end plate **10'**, the latter ends projecting from the end plate so that lead wires may be soldered thereto. Similarly, the alternately-disposed fixed contacts **14'** are bottomed in the bores formed in the upper end plate **10'** and have ends passing through the aligned holes formed in the lower end plate **10**, the latter ends projecting from this end plate, so that lead wires may be soldered thereto. The ends of all of the fixed contacts **14** and **14'** are force-fitted into the respective bores and holes, whereby all components of the switch, with the exception of the operating knob **47**, are retained in proper, operative positions. As shown in the drawing, the rotor member **30** abuts against the lower end plate **10**, thereby closing the cavity which normally carries a set of eight wire springs, the transverse cavity portions **35** and **36** being visible in this particular view. The central rod **21** and the wires **23** are also force-fitted through the appropriate holes formed in the lower end plate, whereby the center post **20**, and the wires **23** and **22**, supoprted thereby, remain fixed realtive to the two end plates. The bearing washers **38** and **38'**, disposed within the bores formed in the adjacent, lower surfaces of the rotor members, and the similar washer **46**, disposed in the bore provided in the flange portion of the end cap **40**,

serve as bearings for rotation of the rotor members about the center post **20**. Included in FIGURE 7, in dotted lines, is one of the drive pins **41**, which is force-fitted through the longitudinally aligned holes formed in the two rotor members and the end cap. Actually, the one rotor member is angularly offset relative to the other rotor member by an angle of 18 degrees. Hence, the protruding portions of the wire spring loops carried by the rotor member **30** will engage a selected one of the fixed contact rods **14** when the corresponding portions of the wire spring loops carried by the rotor member **30'** engage the adjacent one of the fixed contact rods **14'**, and vice versa, as will be described in more detail hereinbelow. Consequently, an electrical circuit is established between a lead wire connected to all of the wires **23**, the wire springs carried by the lower rotor member **30** and one of the fixed contact rods **14**. A second electrical circuit is established between a lead wire connected to the center rod **21**, the wires **22** connected thereto, the wire springs carried by the upper rotor member **30'** and one of the fixed contact rods **14'**. The described arrangement constitutes a two-pole switch having ten (10) fixed contacts associated with each pole.

The disposition of the wire springs in the cavity of the lower rotor member **30** is shown in the fragmentary, central cross-sectional view of FIGURE 8. The lowermost spring **25** has one end loop snugly encircling the wires **23**, carried by the center post **20**, and its intermediate, small loop **28** disposed in the transverse cavity portion **36**. The next spring **25'** is reversely positioned, having one of its end loops snugly encircling the wires **23**, but its intermediate small loop disposed in the other transverse cavity portion **35**. The other six springs are similarly arranged. It is apparent that the intermediate small loops of the springs occupy a space, taken axially of the center post **20**, twice that of the single turn end loops which encircle such post. By positioning the springs so that each is reversely disposed relative to those adjacent thereto, the spring loops which encircle the center post lie in a plane normal to the post axis and abutting each other, although in FIGURE 8 the springs are shown spaced apart, axially, for purposes of clarity of disclosure. The other end loop of each spring has a portion projecting beyond the peripheral surface of the rotor member, see also FIGURE 6. The other rotor member carries a second set of wire springs also arranged as described, above. The springs of each set are loosely confined within the cavity of the associated rotor member and are rotatable therewith about the center post.

Reference now is made to FIGURE 9, which is a fragmentary cross-sectional view taken along a transverse plane passing through the lower rotor member **30**. The two lowermost wire springs **25** and **25'** are disposed within the cavity formed in rotor member, which is rotatable relative to the lower end plate **10** about the common axis of the switch. The inner end loops of each spring snugly encircle the wires **23** whereas the outer end loops are in pressure contact with two adjacent fixed contact rods **14**, **14'**, In the particular case of a switch having **20** fixed contact rods, the spacing between adjacent rods is 18 degrees, as shown. If, now the rotor member is rotated 9 degrees, the outer spring loops will be in engagement solely with one or the other of the fixed rods **14** or **14'**. Such position of the rotor is defined, in a positive manner, by a suitable indexing mechanism carried by the panel on which the switch is mounted. Continued rotation of the rotor member results in the alternated expansion of the springs as the outer loops are centered between adjacent contact rods and a compression of the springs as these loops are centered on one of the contact rods. It will be clear, then, that the individual contact rods **14** can be connected to individual electrical components for selective connection to the central wires **23** upon appropriate rotation of the rotor member **30**.

As described hereinabove, the upper rotor member is angularly offset relative to the lower rotor member by 18 degrees. Thus, when the springs carried by the lower rotor member are in sole engagement with a particular one of the contact rods **14**, the springs carried by the upper rotor member will be in sole engagement with an adjacent contact rod **14'**. The illustrated arrangement results in a short-circuiting type switch useful in specific applications. Specifically, the two common contacts are connected to three, adjacently-disposed fixed contacts as the rotor members are rotated to the position wherein the springs of each rotor member are in sole contact with respectively associated fixed contacts.

By mechanically coupling together the rotor members, by means of the drive pins **40**, **41**, so that they are angularly offset by 180 degrees, the switch becomes a two pole, ten position, make-before-break switch. In this case, the indexing mechanism is arranged to limit rotation of the rotor members to 180 degrees. The ten adjacently-disposed fixed contact rods lying in the upper half-circle of the end plate constitute the ten contacts operatively associated with the springs of the lower rotor member, whereas the remaining contact rods are operatively associated with the springs of the upper rotor member. Further, by making the outer spring loops of a somewhat smaller diameter than those shown in FIGURE 9, the outermost surfaces of the loops will be spaced from adjacent contact rods, when the rotor members are in the illustrated, intermediate positions. Still, such loops will be brought into pressure engagement with the selected single fixed contact, thereby resulting in a switch operating in a break-before-make manner.

Although the various components of the switch may be made of any materials comparable with the intended end use thereof, all of the metal contact members and the springs preferably are made of a silver alloy of high spring temper and high tensile strength, thereby precluding the development of thermal voltages and resulting in a switch having superior electrical characteristics. A switch, made as described, had a contact resistance not exceeding 0.004 ohm, which value changes only an insignificant amount after 1,000,000 switch operations. The cylindrical, or circular shape of all metal components reduces to a minimum the capacitance between such components, whereby the switch is adapted for use in high frequency circuits. The ease of soldering lead wires to the fixed contact rods and common wires is apparent since such members have exposed portions for this purpose. By making the two end plates of Teflon or a silicone asbestos compound, heavy lead cables can be soldered to the contact rods and wires with a minimum possibility of damage occuring during the soldering operation. As a protection against the deleterious action of dust and fumes at the points of contact between the wire springs and the fixed contacts, the central portion of the switch may be enclosed within a thin sheet of plastic **50**, see FIGURE 7, which sheet is carried by the shoulders of the end plates and wrapped around the switch. Such sheet is retained in place by a wide, rubber band **51**.

A modification of the switch construction is shown in FIGURES 10–12, reference being made first to the exploded view of FIGURE 10, which shows the components which go to make up this particular switch. A pair of end plates **55**, **55''**, having integral flange portions **56**, **56'**, are provided with central holes **57**, **57'** for receiving, respectively, the reduced-diameter collar portions of the two rotor members **58**, **58'**, said collar portions being identified by the numerals **59**, **59'**. The end plate **55** is provided with a set of holes **60** and **61**, which holes are aligned with the corresponding holes **60'** and **61'** formed in the other end plate **55'**. The lower rotor member **58**, see also the plan view of FIGURE 11, has formed therein a deep cavity for receiving a plurality of wire contact springs, said cavity comprising a generally circular portion **63** communicating with the laterally-

extending, or transverse portions 64 and 65. One such contact spring is shown in FIGURE 11 and comprises a relatively large outer loop 67 (loosely disposed within the cavity portion 63) an intermediate closed loop 68 (disposed in the cavity portion 65) and an end loop 69 (disposed generally concentric with the axis of the rotor member). As described hereinabove, a plurality of the wire springs are disposed within the cavity with adjacently-positioned springs reversely oriented. Also formed in the rotor member 58 are a pair of diametrically-opposed holes 70 and 71 and an axial bore 72. In the assembled switch, the collar 59, of the rotor member 58, is rotatably disposed within the central hole 57 of the lower end plate 55.

The upper rotor member 58' is provided with a similar, deep cavity (for receiving a second set of the wire springs) and a pair of diametrically-opposed holes 70', 71' corresponding to the similar holes formed in the lower rotor member. In this case, the collar 59' is of extended axial length so that in the assembled switch the collar will project beyond the surface of the upper end plate 57'. Such collar is provided with spaced holes into which are force-fitted the two operating shafts 74 and 75.

A divider plate 77 has a plurality of contact rods 78, 79 force-fitted through suitable holes. The left ends of these rods are adapted to be force-fitted through the holes 60 and 61 in the lower end plate 55 and the right ends of the rods are adapted to be force-fitted through the holes 60', 61' in the upper end plate 55'. These rods constitute the fixed contacts of the switch. The two common contacts of the switch comprise the rods 80 and 81, each rod being positionable in individual radial grooves formed in the opposed surfaces of the divider plate and each rod having an offset portion extending along the plate axis. Also formed in this plate are a pair of symmetrical, arcuate openings 82, 83, which serve as clearance passageways for two plastic drive pins which couple together the two rotor members. A portion of one such drive pin 84 is shown in the drawing. In the assembled switch, the left end of this pin is disposed in the hole 70 of the rotor member 58 and the right pin and is disposed in the aligned hole 70' of the other rotor member 58'. The second drive pin, not visible in this particular view, has its ends disposed in the corresponding holes 71 and 71' of the two rotor members. The axially-extending end of the center contact rod 81 fits into the bearing washer 85, which washer is receivable in the axial bore 72 of the lower end plate. Similarly, the axially-extending end of the other center contact rod 80 fits into the bearing washer 86, which washer is receivable in the axial bore 72' of the upper end plate.

The assembled switch is shown in the enlarged, central, cross-sectional view of FIGURE 12. The two rotor members are clamped between the end plates 55, 55 and the divider plate 77 by means of the fixed contact rods 78, 79 which are force-fitted through the longitudinally-aligned holes of the divider plate and the end plates. The collar 59 and washer 85, of the rotor member 58, and the collar 59' and washer 86, of the rotor member 88', form bearings for the rotation of the rotor members about the switch axis. The rotor members rotate as a unit, being mechanically coupled together by the two drive pins, which pins, not visible in this particular view, pass through the arcuate openings formed in the divider plate 77. A set of the wire contact springs 88 are disposed within the cavity of the rotor member 58, each spring having the small end loop snugly encircling the center contact rod 80, intermediate, closed loops disposed in one or the other of the transverse portions of the cavity, and relatively large end loops projecting outwardly of the rotor member in pressure contact with a selected one of the fixed contact rods 78. Although these wire springs are of somewhat different configuration than the springs 25, 25', shown in FIGURES 1 and 6, the outer loops engage the fixed contact rods in the same manner as those described hereinabove, with specific reference to FIGURE 9. It will be clear, now, that electrical continuity is established between the common contact 80 and a selected one of the fixed contacts 78 by means of the wire springs 88. The upper rotor member 58' carries a similar set of wire springs 88' having end loops snugly encircling the center contact rod 81. This rotor, however, is angularly offset from the other rotor by an angle of 180 degrees whereby electrical continuity is established between the common rod 81 and a selected one of the fixed contact rods 79. The components of the switch shown in FIGURE 12 preferably are made of the same materials as the corresponding components of the switch shown in FIGURE 7.

Having now given a detailed description of two embodiments of the invention, those skilled in this art will be able to make various changes and modifications to meet specific requirements without thereby departing from the spirit and scope of the invention as recited in the following claims.

I claim:

1. In a multi-point rotary electrical switch of the class having a fixed common contact and a plurality of stationary contacts and wherein electrical continuity between the common contact and a selected one of the stationary contacts is established by means including a rotatable member, the improvement wherein the rotatable member is a cylindrical member having an axially-extending cavity formed therein, which cavity comprises laterally-extending portions communicating with an intermediate radial portion extending to the peripheral surface of the cylindrical member, and a plurality of wire springs disposed in the said cavity, each spring having an end formed into a loop in engagement with the said common contact and the other end formed into a loop which extends beyond the peripheral surface of the cylindrical member and into engagement with the selected stationary contact.

2. A multi-point rotary switch comprising,

(a) spaced stator members,

(b) a plurality of contact rods carried by the stator members, said rods being arcuately spaced along a common circle,

(c) a cylindrical rotor member disposed between the stator members and having an axially-extending cavity formed therein, which cavity comprises a radial portion extending from the peripheral surface of the rotor member and communicating with laterally-extending portions,

(d) means mounting the rotor member for rotation relative to the stator members,

(e) fixed common contact means extending axially of the rotor member and into the said cavity, and

(f) a plurality of adjacently-positioned wire springs disposed within the cavity, said springs each having one end portion engaging the said fixed contact means and the other end portion extending through the radial portion of the cavity and sequentially engaging the contact rods upon rotation of the rotor member.

3. The invention as recited in claim 2, wherein the rotor member has a diameter less than the said common circle and the end portions of the wire springs are formed into circular loops.

4. The invention as recited in claim 3, wherein the said common contact means comprises a plurality of contact wires spaced equally from the axis of the rotor member and having ends projecting from a stator member, and wherein corresponding end loops of the wire springs encircle the said contact wires.

5. The invention as recited in claim 3, wherein the said common contact means comprises a rod having a radially-offset portion extending beyond the said contact rods, and wherein corresponding end loops of the wire

springs encircle the axially-extending portion of the said rod.

6. The invention as recited in claim 3, wherein each wire spring includes an intermediate closed loop, and wherein the intermediate loop of adjacently positioned springs are disposed in different laterally-extending portions of the cavity.

7. A double-pole, multi-point rotary siwtch comprising,

(a) spaced stator members,

(b) a plurality of fixed contact rods carried by the stator members, said rods being arcuately spaced along a common circle,

(c) first and second cylindrical rotor members disposed between the stator members, each rotor member having an axially-extending cavity formed therein which cavity comprises a radial portion extending from the peripheral surface of the rotor member and communicating with laterally-extending portions,

(d) means mounting the rotor members for rotation as a unit relative to the stator members,

(e) a first common contact means extending axially into the cavity of the first rotor member,

(f) a second common contact means extending axially into the cavity of the second rotor member,

(g) a first set of adjacently-positioned wire springs disposed within the first rotor member, each spring having an inner end loop in encircling engagement with the said first common contact means, an outer end loop having a portion extending through the radial portion of the cavity and into engagement with one of said fixed contact rods, and an intermediate closed loop lying in one or the other of the cavity laterally-extending portions, and

(h) a second set of adjacently-positioned similar wire springs disposed within the cavity of the second rotor member, the inner end loops being in encircling engagement with the said second common contact means, the outer end loop having portions extending through the radial portion of the cavity and into engagement with one of the said fixed contact rods, and intermediate closed loops lying in one or the other of the cavity laterally-extending portions.

8. The invention as recited in claim 7, wherein the two rotor members are angularly offset relative to each other.

9. The invention as recited in claim 8, wherein the rotor members are angularly offset by an angle of 180 degrees.

10. The invention as recited in claim 7, wherein the said first common contact means comprises a first set of common contact wires spaced equally from the axis of the first rotor member and having ends projecting from one stator member, and wherein the said second common contact means comprises a second set of common contact wires spaced equally from the axis of the second rotor member and electrically connected to an axial contact rod having an end projecting from the said one stator member.

11. The invention as recited in claim 7, including a fixed divider plate disposed between the two rotor members, said plate having oppositely-directed radial slots formed in the opposed surfaces thereof, wherein the said first common contact means comprises a first common rod having an offset portion disposed in one of the radial slots of the plate and an end extending therefrom, and wherein the said second common contact means comprises a second common rod having an offset portion disposed in the other radial slot of the plate and extending therefrom.

12. The invention as recited in claim 11, wherein the said fixed contact rods carried by the stator members pass through holes formed in the divider plate.

13. The invention as recited in claim 11, wherein the first rotor member includes a reduced-diameter collar disposed in an axial bore formed in one of the stator members, wherein the second rotor member includes a reduced-diameter collar passing through an axial hole formed in the other stator member, and including a pair of spaced, parallel operating rods having ends fitted into bores formed in the collar of the second rotor member.

14. The invention as recited in claim 7, wherein one of the rotor members has a reduced-diameter collar passing through an axial bore formed in one of the stator members, and including a pair of spaced, parallel operating rods having ends fitted into bores formed in said collar member.

No references cited.

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