

- [54] CONTACT SPRING AND SWITCH CONSTRUCTION

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[57] ABSTRACT

The contact spring of this invention comprises a dielectric spring member having a base portion and a generally linear cantilever portion extending from the base portion. A generally linear discrete conductor is mounted on the spring member in close proximity thereto. The conductor extends along the length of the cantilever portion and is so mounted on the spring member that the portion of the conductor extending adjacent to the free end of the cantilever portion is movable longitudinally relative to the cantilever portion when the cantilever portion is deflected.

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[51] Int. Cl. H01h 1/26

[58] **Field of Search** .. 200/166 J, 1 A, 1 TK, 166 H,
200/166 PC, 166 BG

[56] **References Cited**

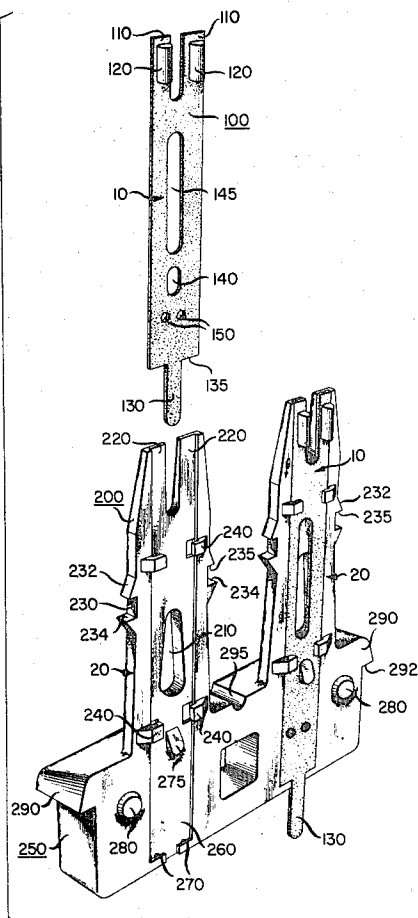
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20 Claims, 7 Drawing Figures



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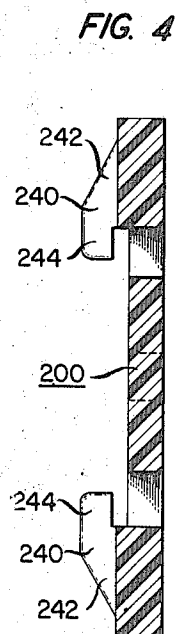
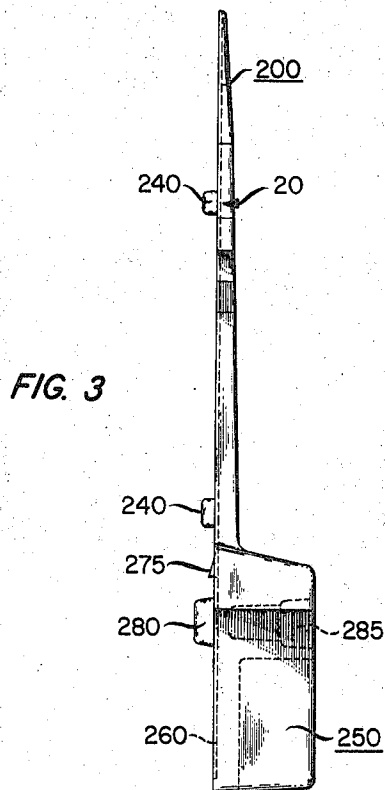
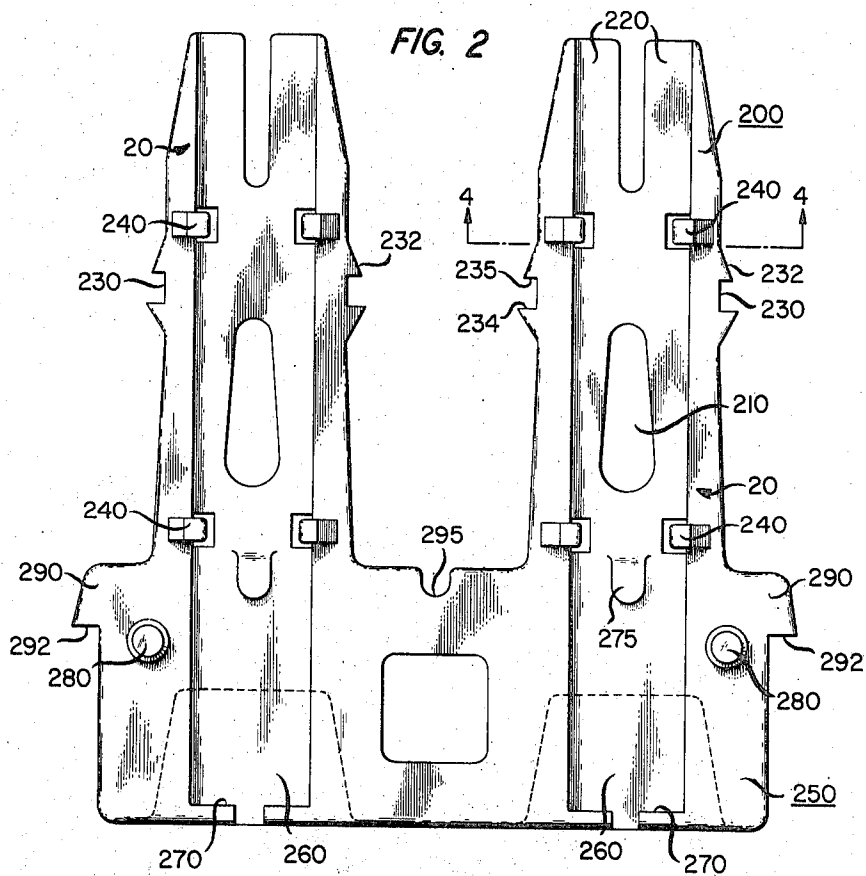


FIG. 5

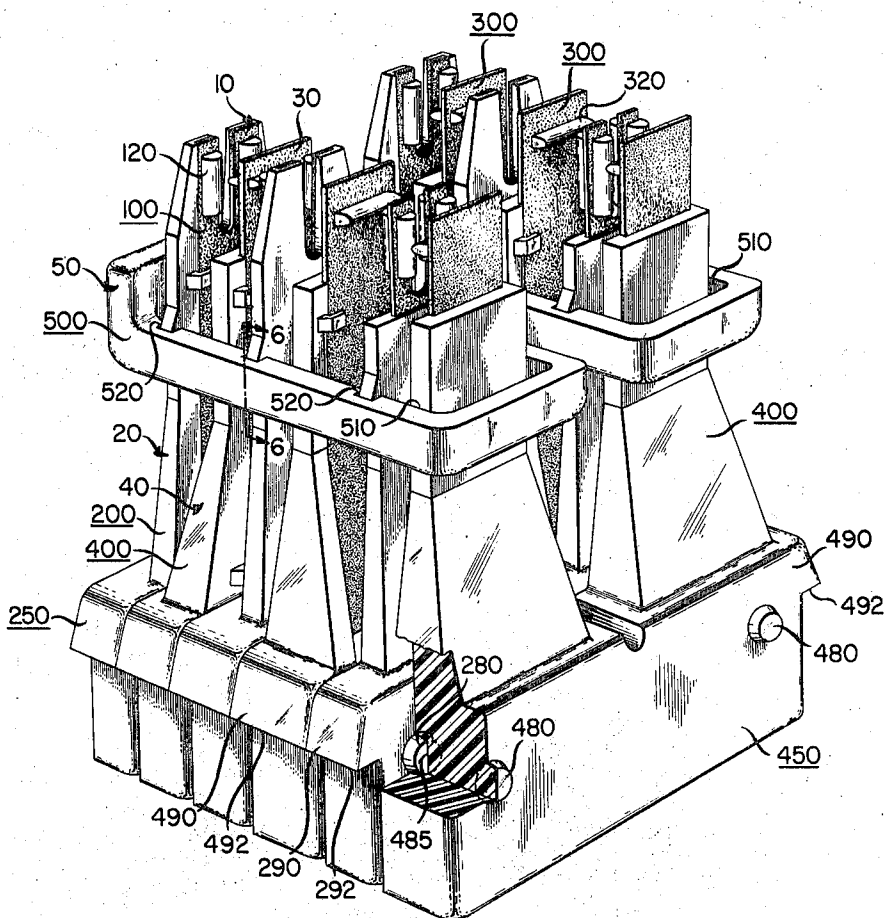


FIG. 6

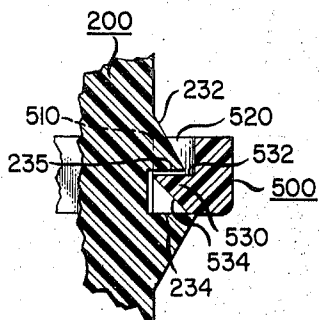
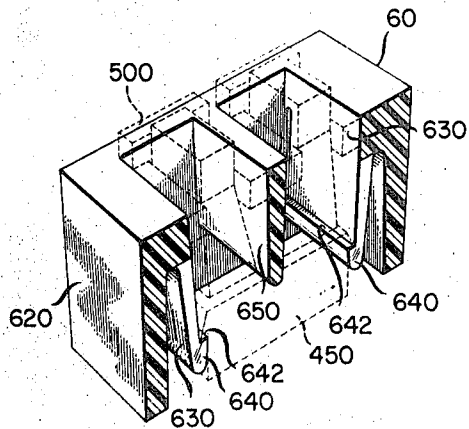


FIG. 7



CONTACT SPRING AND SWITCH CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of electrical switches and within that field to contact spring and switch construction wherein the contact springs are formed from a resilient dielectric material.

2. Description of the Prior Art

A very common switch employed in relays and other applications comprises a plurality of cantilevered, parallel extending, electrically conductive contact springs arranged in a column. In the manufacture of this switch, dielectric separators are placed between the contact springs at their base end to electrically isolate and space the springs from one another, the contact springs and separators are aligned, and fasteners are inserted through the contact springs and separators to secure the assembly together, means being provided to electrically isolate the fasteners from the contact springs. Thereafter, the free ends of the contact springs are adjusted to obtain the desired contact pressure when they are in engagement with one another and the desired spacing when they are separated. Because the foregoing operations do not lend themselves to automation, switches of this type are assembled and adjusted by hand and therefore are relatively expensive to manufacture.

A column type switch design that is more amenable to automated manufacture is disclosed in U.S. Pat. No. 3,657,673 issued to W. Hagen on Apr. 18, 1972. In Hagen, the contact springs consist of flexible plates of insulating material having uniformly spaced parallel conductive paths deposited on one or both sides thereof by printed circuit techniques. The plates of insulating material are dimensioned to provide the desired spring characteristics while the conductive paths are dimensioned to provide the desired current carrying capacity. The base end of each plate is provided with a row of alternate protrusions and grooves on each side thereof, the grooves being of a size to accommodate the protrusions and the protrusions in the row on one side being aligned with the grooves in the row on the other side. In addition, the contact end of each conductive path is advantageously augmented by depositing additional conductive material thereon or by riveting a contact element thereto.

In the assembly of the switch, the plates are arranged in a column with the conductive paths on the plates facing the conductive paths on the adjacent plates and with the protrusions on the plates in engagement with the grooves on the adjacent plates. A spring clip is thereafter positioned around the end plates of the column to secure the group of plates together. The protrusions and grooves on the plates respectively cooperate to automatically locate the facing conductive paths in alignment with one another. The protrusions and grooves also advantageously cooperate to provide the desired spacing between the conductive paths on adjacent plates when they are in their open position.

In addition to facilitating the assembly of a column type switch, the contact springs of Hagen have the advantage of having a lower modulus of rigidity and density than the conventional contact spring. Consequently, the contact spring of Hagen can be made

much smaller than a conventional contact spring without increasing the stiffness of the spring to an undesirable level and the spring will be lighter than the same size conventional spring.

However, the contact spring of Hagen also has several disadvantages over conventional contact springs. First of all, a deposited or printed conductor has less fatigue strength and greater stress relaxation than a properly designed conventional contact spring. As a result, when a printed conductor is an element of a contact spring that is subjected to repetitive flexure, it will fracture sooner than and thereby have a shorter life than the conventional contact spring. In addition, when a printed conductor is an element of a contact spring that is subjected to prolonged deflection, it will relax more than and thereby have less uniformity of contact pressure than the conventional contact spring.

Furthermore, each time the contact spring of Hagen is deflected, it is subjected to sheer stress at the interface between the printed conductor and the insulating plate. This sheer stress acts to separate the conductor from the plate and is therefore likely to have an adverse effect on the life of the contact spring.

Finally, while printed circuit techniques lend themselves to automation, they are expensive compared to conventional conductor forming techniques. Thus, while cost savings would be effected in the assembly of the switch of Hagen, the savings would be offset by the higher cost of making the contact springs.

SUMMARY OF THE INVENTION

The contact spring and switch construction of this invention combine the advantages of the conventional contact spring with the advantages of the Hagen type contact spring. The contact spring of this invention comprises a dielectric spring member having a base portion and a generally linear cantilever portion extending from the base portion. A generally linear discrete conductor is mounted on the spring member in close proximity thereto. The conductor extends along the length of the cantilever portion and is so mounted on the spring member that the portion of the conductor extending adjacent to the free end of the cantilever portion is movable longitudinally relative to the cantilever portion when the cantilever portion is deflected.

Inasmuch as the conductor is a separate and distinct element of the contact spring it can be formed by conventional manufacturing techniques from a material having optimum contact spring characteristics. Thus, while its dimensions are selected to meet its requirements as a conductor rather than as a spring member, it enhances rather than detracts from the performance of the contact spring of which it is an element. In addition, because the conductor is separate and distinct from the spring member, the perfected and inexpensive method of welding can be used to attach contact elements to the conductor prior to its assembly to the spring member.

Furthermore, because the conductor moves longitudinally relative to the cantilever portion of the spring member when the cantilever portion is deflected, there is no sheer stress generated at the interface between the conductor and the cantilever portion. The net result is that a contact spring of this construction has an even lower modulus of rigidity than the contact spring of Hagen permitting even greater miniaturization of this contact spring. Still further, because the conductor is

mounted in close proximity to the spring member, the longitudinal relative movement between the conductor and the cantilever portion of the spring provides a damping effect that reduces contact bounce.

In one specific embodiment, the conductor comprises a conductive strip while the cantilever portion of the spring member includes a pair of opposed fingers for receiving the conductive strip therebetween and holding the strip close to the adjacent surface of the spring member. The conductive strip is inserted longitudinally between the fingers, and the base portion of the spring member includes a stop against which the conductive strip is placed to locate it in the proper longitudinal position on the spring member. The base portion also includes a wedge-shaped boss, the thick end of which faces in the opposite direction to the arresting surface of the stop and the conductive strip includes an opening therein for receiving the boss when the strip is positioned against the stop. The base portion further includes a tapered stud on one face thereof and a tapered cavity on the other face thereof in alignment with and of a configuration to accommodate the stud, the cavity having slightly smaller dimensions than the stud.

The fingers, stop, and wedge-shaped boss of the spring member cooperate with the conductive strip and the opening therein to secure the strip to the spring member without the use of fasteners. Similarly, the tapered stud of one spring member cooperates with the aligned tapered cavity of an adjacent spring member to secure the spring members together without the use of fasteners. Finally, this construction facilitates the automated manufacture of the conductive strip and spring member, the automated assembly of the conductive strip to the spring member to form an individual contact spring, and the automated assembly of a multiplicity of contact springs to form a column type switch.

DESCRIPTION OF THE DRAWING

FIG. 1 is a partially exploded perspective view of a movable contact spring pair in accordance with this invention, each contact spring comprising a discrete conductor supported on a dielectric spring member;

FIG. 2 is a front view of the spring members shown in FIG. 1;

FIG. 3 is a side view of the spring members;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a perspective view of a pair of switches in accordance with this invention, the switches incorporating the movable contact springs of FIG. 1;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5 showing the manner in which the switch actuator interlocks with the movable spring members; and

FIG. 7 is a perspective view of an enclosure for the switches of FIG. 5, the front wall of the enclosure being broken away for greater clarity and the switches being shown in phantom.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 of the drawing, a movable contact spring in accordance with this invention consists of a discrete conductor 10 mounted on a spring member 20. The conductor 10 comprises a conductive strip 100, the upper end of which includes bifurcations 110 that have contact elements 120 respectively at-

tached thereto, the contact elements extending parallel to the length of the strip. The lower end of the strip 100 includes a terminal post 130 that advantageously has approximately the same length and width and is situated in alignment with the opening between the bifurcations 110, the juncture of the terminal post with the main body of the strip providing shoulders 135. A latching opening 140 is situated above the shoulders 135, and a stiffness reducing opening 145 is located between the latching opening and the bifurcations 110.

The conductive strip 100 is formed from a material having optimum contact spring characteristics such as nickel-silver but its dimensions are selected firstly to meet its requirements as a conductor and secondly to facilitate its manufacture and its assembly to the spring member 20. It is obvious, however, that in addition to the desirable spring characteristics of high fatigue strength and low stress relaxation that the strip 100 contributes to the contact spring, it also contributes stiffness. Thus, the stiffness reducing opening 145 is included where necessary so that when the strip 100 is assembled to the spring member 20 the stiffness of the contact spring thereby formed is at the desired level.

The shape of the strip 100 lends itself to automated manufacture since it can be formed from a continuous ribbon that first has the openings 140 and 145 punched therein, then has the contact elements 120 welded thereto, and finally has the bifurcations 110 cut therein at the same time that it is sheared from the continuous ribbon, the portion cut away to form the bifurcations providing the terminal post 130 for the subsequent strip. The strip 100 is advantageously assembled to the associated spring member 20 immediately following the final operation, a pair of assembly holes 150 being provided below the latching opening 140 for automated insertion of the strip into its proper position on the spring member.

Referring now also to FIGS. 2, 3, and 4, the spring member 20 may be formed either singly or in multiples wherein two or more spring members are positioned side by side and the base portion of one spring member is merged with the base portion of the adjacent spring member to form a composite spring member. In the embodiment shown, two spring members 20 are paired and for purposes of brevity only one will be described in detail, the other being essentially identical.

The spring member 20 comprises a generally linear cantilever portion 200, extending from a base portion 250. The cantilever portion 200 which is thinner than the base portion 250, is advantageously coplanar with the front of the base portion and is shaped to provide the desired flexibility, an opening 210 being provided therein when necessary to further reduce its stiffness. The free end of the cantilever portion 200 has bifurcations 220 that are approximately the same length as the bifurcations 110 of the conductive strip 100, while each side edge of the cantilever portion has a notch 230 and a flared surface 232 leading to the notch. The notches 230 and flared surfaces 232 are aligned with one another, and a lower surface 234 of each notch extends out a slightly greater distance than an upper surface 235 thereof.

The cantilever portion 200 also includes spaced pairs of opposed fingers 240 in between the bifurcations 210 and the base portion 250, and as shown most clearly in FIG. 4, each of the fingers 240 comprises an upstanding leg 242 extending outwardly from the cantilever por-

tion and a holding leg 244 extending toward the holding leg of the opposing finger. The distance between the facing surfaces of the upstanding legs 242 is approximately the same as the width of the conductive strip 100, while the distance between the inside surface of each holding leg and the adjacent surface of the cantilever portion 200 is approximately the same as the thickness of the strip.

The cantilever portion 200 and base portion 250 both have a recess 260 therein for locating the conductive strip 100 in its proper position on the spring member 20 and for accommodating the strip approximately flush with the surface of the spring member, the width of the recess 260 being approximately coextensive with the facing surfaces of the upstanding legs 242. The lower end of the recess 260 narrows to a width of a size to accommodate the terminal post 130 and the lateral surfaces at this point provide a stop 270 against which the strip 100 is positioned. In addition, the stop 270 cooperates with a wedge-shaped boss 275 to secure the strip 100 in place, the thick end of the boss facing in the opposite direction to that of the arresting surface of the stop.

The base portion 250 also includes a pair of tapered studs 280 on the front face thereof and a pair of tapered cavities 285 in the rear face thereof in alignment with the studs. The cavities 285 are of a configuration to respectively accommodate the studs 280 but have slightly smaller dimensions than the studs. Finally, the side edges of the base portion 250 each have a lip 290 extending outwardly therefrom, each lip having a planar under surface 292, and a bearing surface 295 facing opposite to the under surface is located between the lips. As is seen from the drawing, in the base of a composite contact spring the pairs of studs 280, cavities 285, lips 290, and the bearing surface 295 are shared by the multiple contact springs forming the composite.

The spring member 20 is formed from a flexible dielectric material and is advantageously molded as a unitary member using a thermoplastic resin such as 10 percent glass reinforced polycarbonate or polysulfon. These thermoplastic materials have two distinct advantages over conventional spring materials such as phosphor bronze or beryllium copper. First, the density of these thermoplastic materials is approximately one-sixth that of the conventional spring materials and spring members formed from the former will be considerably lighter than the same size spring formed from the latter. Besides reducing the weight of switches in which that contact member is employed, the reduced mass of the movable contact spring provides faster operation of the switch. Second, the modulus of elasticity of these thermoplastic materials is approximately one-thirtieth that of the conventional spring materials, and therefore spring members formed from these thermoplastic materials can be made significantly smaller without increasing the stiffness of the spring members to an undesirable level. In addition, less force is required to deflect such a spring member whereby proportionally less stress occurs in the spring member when it is deflected. Furthermore, these materials have the necessary fatigue strength to sustain reasonable flexural stress for more than five million cycles. These thermoplastic resins are therefore well suited to perform as the spring member of a contact spring.

Stress relaxation of the cantilever portion 200 is greatly reduced by shaping it to provide a beam of generally uniform strength and thereby generally uniform stress distribution, both the width and the thickness of the cantilever portion being tapered toward the free end thereof to achieve this result. In addition, generous radii are provided at the juncture of the cantilever portion 200 with the base portion 250 to further reduce stress concentrations in the spring member 20.

Forming the spring member 20 by molding provides a relatively complex component that is held to close tolerances, yet is inexpensive to manufacture. Furthermore, by molding the spring member 20 using the process disclosed in U.S. Pat. No. 3,192,298 issued to E. H. Fisher on June 29, 1965, a continuous string of uniformly oriented spring members is automatically produced, facilitating the automated assembly of the conductive strip 100 to each spring member.

As seen from FIG. 1, all that is necessary to secure the conductive strip 100 to the spring member 20 is to insert the conductive strip, terminal post 130 first, into the recess 260 of the spring member. The recess 260 directs the conductive strip 100 beneath the fingers 240, and then just as the shoulders 135 of the strip engage the stop 270, the latching opening 140 snaps over the wedge-shaped boss 275. The fingers 240 hold the strip 100 in close proximity to the spring member 20 and in cooperation with the stop 270 and the boss 275 secure the strip in place.

The fingers 240 in combination with the recess 260 prevent lateral movement of the strip 100 relative to the spring member 20. In addition, the stop 270 and boss 275 of the spring member 20 in combination with the shoulders 135 and opening 140 of the strip 100 prevent longitudinal movement of the portion of the strip adjacent to the base portion 250. However, it is clear from FIG. 1 that the portion of the strip 100 adjacent to the cantilever portion 200 is free to move longitudinally relative to the cantilever portion when that portion is deflected. The benefits derived from this arrangement are set forth in the summary of the invention.

Turning now to FIG. 5, it is seen that the movable contact springs of the above-described type are combined with stationary contact springs to form a column-type switch including make, break, and transfer contacts. The stationary contact springs are similar to the movable contact springs in that they consist of a discrete conductor 30 secured to a dielectric spring member 40 comprising a cantilever portion 400 extending from a base portion 450. The conductor 30 comprises a conductive strip 300 that is the same as the conductive strip 100 except that the upper end of the strip 300 is not bifurcated and it has a single contact element 320 that extends transverse to the length of the strip.

The base portion 450 of the stationary spring members 40 is identical to the base portion 250 of the movable spring members 20 and therefore includes tapered studs 480 on one face thereof and tapered cavities 485 on the other face thereof that are respectively the same size and configuration and have the same orientation as the studs 280 and cavities 285. As a result, the movable and stationary contact springs are assembled by merely pressing them together to force the studs of one contact spring into the cavities of the adjacent contact spring, the interference fit between the studs and cavities se-

curing the contact springs together. Furthermore, the base portion 450 has lips 490 extending outwardly from the side edges thereof and a bearing surface 495 intermediate the lips facing opposite to planar under surfaces 492 of the lips.

The cantilever portion 400 of the stationary spring members 40 differs from the cantilever portion 200 of the movable spring members 20 in that it is shaped to be less flexible. In addition, the cantilever portion 400 does not extend to the upper end of the conductive strip 300. Consequently, when the movable contact springs engage the stationary contact springs, both the conductor 100 and the cantilever portion 200 of the former are deflected, whereas only the upper end of the conductor 300 of the latter is deflected, the interaction therebetween providing the desired wiping of the contacts.

One additional difference between the stationary spring members 40 and the movable spring members 20 is that the side edges of the cantilever portion 400 of the former are spaced closer together and do not have notches therein. As a result, only the side edges of the cantilever portions 200 of the movable spring members 20 are engaged by an actuator 50 of the switch. The actuator comprises a unitary flexible rectangular ring 500 having a pair of facing inside surfaces 510 spaced apart a distance slightly less than the distance between the side edges of the cantilever portions 200 of the movable spring members 20 immediately adjacent to the notches 230. The inside surfaces 510 have aligned pairs of grooves 520, only one of each pair being shown, and the pairs of grooves are spaced along the surfaces 510 to coincide with the spacing between the movable spring members 20.

The width of each pair of grooves 520 is approximately the same as the thickness of the cantilevered portion 200 of the associated movable spring member 20 immediately adjacent the notches 230. As seen in FIG. 6, the depth of each groove 520 is less than the length of the bottom surface 234 and greater than the length of the upper surface 235 of the associated notch 230. Furthermore, each groove 520 has a tongue 530 extending transverse to the width of the groove. An upper surface 532 of the tongue 530 extends in a generally horizontal plane and is spaced from the bottom of the ring 500 a distance slightly less than the distance between the lower surface 234 and the upper surface 235 of the associated notch 230. A lower surface 534 of the tongue is inclined upwardly toward the tip of the tongue 530.

As a result of these relationships, the ring 500 is secured to the movable spring members 20 by positioning it so that the grooves 520 are aligned with the upper ends of the cantilevered portions 200. The ring 500 is then moved downwardly, and as the inclined lower surfaces 534 of the tongues 530 engage the flared surfaces 232, the sides of the ring are flexed outwardly. However, when the upper surfaces 532 of the tongues 530 clear the upper surfaces 235 of the notches 230, the sides of the ring snap back toward one another, moving the tongues 530 into the notches. The underside of the ring 500 thereupon rests on the lower surfaces 234 of the notches 230, while the grooves 520 embrace the front and back of the associated cantilever portion 200. From the foregoing, it is clear that this construction is inexpensive to manufacture, permits assembly without the use of fasteners, and lends itself to automation.

Referring now also to FIG. 7, the aforescribed switch assembly is accommodated within a rectangular enclosure 60. The enclosure 60 includes opposed interior sides 620 having flexible latch fingers 630 extending therefrom. Each latch finger 630 has a lip 640 extending toward the lip of the other latch finger and including a planar upper surface 642. The tips of the lips 640 are normally spaced closer together than the distance between the tips of the oppositely facing lips 290 and 490 of the spring members 20 and 40, respectively. The enclosure 60 further includes a depending rib 650 in between the latch fingers 630 for engaging the bearing surfaces 295 and 495 of the spring members 20 and 40, respectively.

The latch fingers 630 and rib 650 are so arranged that when the switch assembly is moved up into the enclosure 60, the latch fingers are deflected away from one another by the engagement of the lips 290 and 490 of the spring members 20 and 40 with the lips 640 of the enclosure. This deflection continues until the bearing surfaces 295 and 495 of the spring members 20 and 40 engage the lower end of the rib 650. At that point the upper surfaces 642 of the lips 640 clear the under surfaces 292 and 492 of the lips 290 and 490, and the latch fingers 630 move toward one another to place the lips 640 beneath the lips 290 and 490 and thereby secure the switch assembly within the enclosure 60. Again it is clear that this construction is inexpensive to manufacture, permits assembly without the use of fasteners, and lends itself to automation.

Although a specific embodiment of the invention has been shown and described, it is understood that it is but illustrative and that various modifications may be made thereon without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A contact spring comprising:

a dielectric spring member having a base portion and a generally linear cantilever portion extending from the base portion;

and a generally linear discrete conductor mounted on the spring member in close proximity thereto, the conductor extending along the length of the cantilever portion, the conductor being so mounted on the spring member that the portion of the conductor extending adjacent to the free end of the cantilever portion is movable longitudinally relative to the cantilever portion when the cantilever portion is deflected.

2. A contact spring as in claim 1 wherein the cantilever portion of the spring member is shaped to form a beam of generally uniform strength.

3. A contact spring as in claim 2 wherein both the width and the thickness of the cantilever portion of the spring member tapers toward the free end thereof to form a beam of generally uniform strength.

4. A contact spring as in claim 1 wherein the cantilever portion of the spring member includes means for holding the conductor in close proximity to the adjacent surface of the spring member.

5. A contact spring as in claim 4 wherein the conductor comprises a conductive strip and the holding means comprises a pair of spaced fingers, each finger comprising an upstanding leg extending outwardly from the surface of the spring member and a holding leg extending toward the holding leg of the other finger, the holding legs being spaced from the adjacent surface of the

spring member a distance approximately the same as the thickness of the conductive strip.

6. A contact spring as in claim 4 wherein the holding means also prevents lateral displacement of the conductor relative to the spring member.

7. A contact spring as in claim 6 wherein the conductor comprises a conductive strip and the holding means comprises a pair of spaced fingers, each finger comprising an upstanding leg extending outwardly from the surface of the spring member and a holding leg extending toward the holding leg of the other finger, the upstanding legs being spaced apart a distance approximately the same as the width of the conductive strip, and the holding legs being spaced from the adjacent surface of the spring member a distance approximately the same as the thickness of the conductive strip.

8. A contact spring as in claim 7 wherein the base portion of the spring member includes a stop against which the conductive strip is placed to locate it in the proper longitudinal position with respect to the fingers.

9. A contact spring as in claim 8 wherein the base portion of the spring member further includes a wedge-shaped boss, the thick end of the boss facing in the opposite direction to the surface of the stop against which the conductive strip is positioned, and the conductive strip includes an opening for accommodating the boss when the strip is positioned against the stop, the boss and stop cooperating to prevent the portion of the conductive strip adjacent to the base portion of the spring member from moving longitudinally relative to the spring member.

10. A contact spring as in claim 9 wherein the base portion further includes a tapered stud on one face thereof and a tapered cavity on the other face thereof in alignment with the stud and of a configuration to accommodate the stud, the cavity having slightly smaller dimensions than the stud whereby when a plurality of spring members are positioned in engagement with one another the stud of one engages the cavity of another and the interference fit therebetween serves to secure the spring members together.

11. A contact spring as in claim 7 wherein the adjacent surface of the spring member includes a recess for accommodating the conductive strip, the width of the recess being generally coextensive with the facing surfaces of the upstanding legs and the depth of the recess being approximately the same as the thickness of the conductive strip.

12. A contact spring as in claim 4 wherein the conductor comprises a conductive strip and the adjacent surface of the spring member includes a recess for accommodating the conductive strip and preventing lateral displacement of the conductive strip relative to the spring member.

13. A contact spring as in claim 4 wherein the conductor comprises a conductive strip and the base portion of the spring member includes a stop against which the conductive strip is positioned when properly located with respect to the holding means.

14. A contact spring as in claim 13 wherein the base portion of the spring member further includes a wedge-shaped boss, the thick end of the boss facing in the opposite direction to the surface of the stop against which the conductive strip is positioned, and the conductive strip includes an opening for accommodating the boss when the strip is positioned against the stop, the boss

and stop cooperating to prevent the portion of the conductive strip adjacent to the base portion of the spring member from moving longitudinally relative to the spring member.

15. A contact spring as in claim 14 wherein the base portion further includes a tapered stud on one face thereof and a tapered cavity on the other face thereof in alignment with the stud and of a configuration to accommodate the stud, the cavity having slightly smaller dimensions than the stud whereby when a plurality of spring members are positioned in engagement with one another the stud of one engages the cavity of another and the interference fit therebetween serves to secure the spring members together.

16. A switch comprising:
a plurality of contact springs, each contact spring including
a dielectric spring member having a base portion and a ribbon-like cantilever portion extending from the base portion; and
a generally linear discrete conductor mounted on the spring member in close proximity thereof, the conductor extending along the length of the cantilever portion and having a width less than the width of the cantilever portion, the conductor being so mounted on the spring member that the portion of the conductor adjacent to the free end of the cantilever portion is movable longitudinally relative to the cantilever portion when the cantilever portion is deflected,

the contact springs being positioned adjacent to one another in a column with the cantilever portions of the spring members in general alignment with and extending generally parallel to one another, the cantilever portion of at least one contact spring being movable and the side edges of the cantilever portion of each movable contact spring having a pair of opposed notches therein,

a unitary flexible ring-like actuator disposed about the contact springs, the actuator having a pair of facing inside surfaces spaced apart a distance less than the distance between the side edges of the movable contact springs in the vicinity of the notches, in addition the inside surfaces having a pair of opposed grooves therein for each movable contact spring, each of the opposed grooves having a width approximately the same as the thickness of the associated movable contact spring and having a tongue extending transverse to the width of the groove, the sides of the grooves embracing the associated movable contact spring and the tongues extending into the notches thereof.

17. A switch as in claim 16 wherein the side edges of the movable contact springs include flared surfaces leading to the notches, and the lower surface of each tongue is inclined toward the upper surface thereof.

18. A switch as in claim 16 wherein the base portion of each spring member includes means for properly locating the spring member with respect to the adjacent spring member and for frictionally securing adjacent spring members together.

19. A switch as in claim 16 wherein the base portion of at least one spring member includes a lip extending outwardly from each side edge thereof and the base portion of at least one spring member includes a bearing surface facing opposite to the under surfaces of the lips and located between the lips.

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20. A switch as in claim 19 further including a rectangular enclosure for accommodating the column of contact springs, each of two opposed interior sides of the enclosure having a flexible latch finger extending therefrom toward the other, each latch finger having a lip extending toward the lip of the other latch finger, the tips of the latch finger lips being normally spaced closer together than the distance between the tips of the base portion lips, the enclosure further including a

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depending rib in between the latch fingers for engaging the base portion bearing surface, the spatial relationship between the latch fingers and the rib being such that the upper surface of the latch finger lips engage the under surfaces of the base portion lips when the rib is positioned in engagement with the base portion bearing surface.

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