

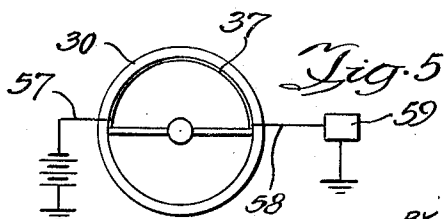
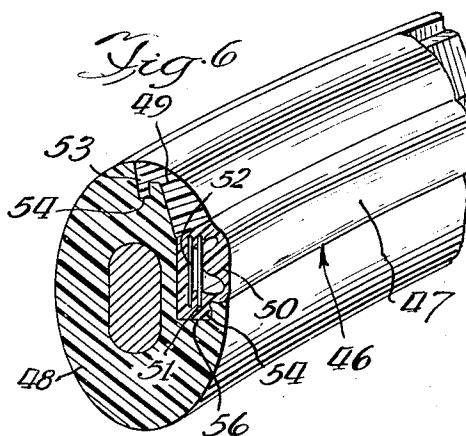
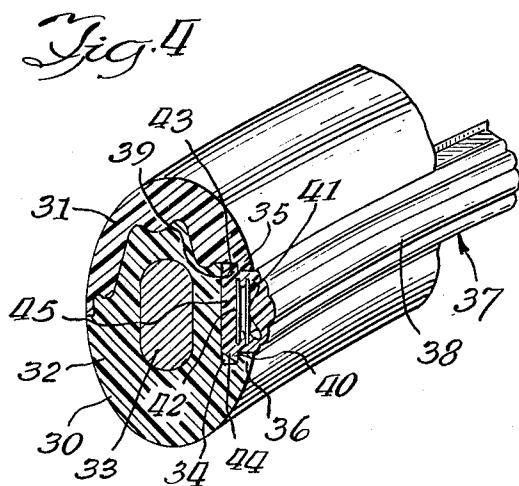
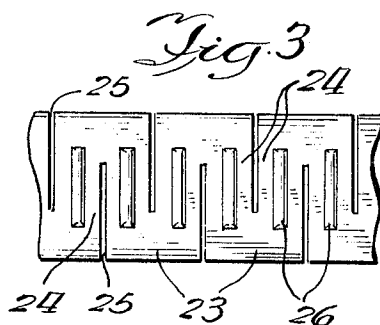
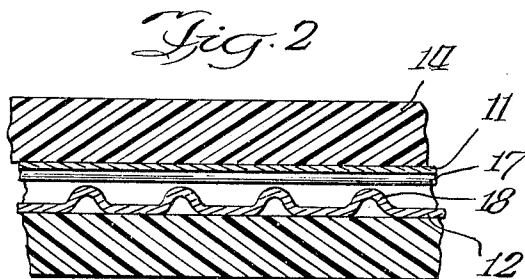
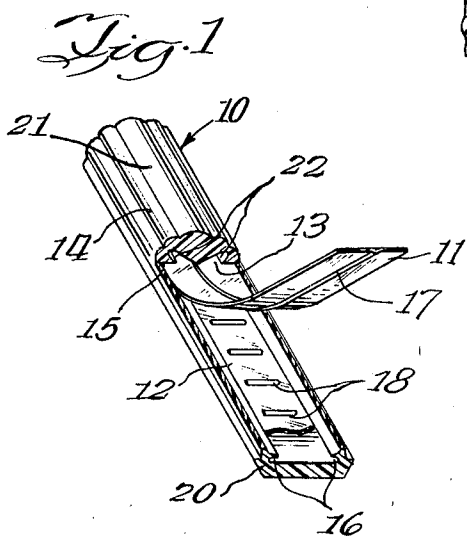
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MOMENTARY CONTACT SWITCHES FOR CONTROL OF ACCESSORY CIRCUITS

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**MOMENTARY CONTACT SWITCHES FOR
CONTROL OF ACCESSORY CIRCUITS**

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9 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to electrical switches of the type having metallic contacts in the form of ribbon-like metallic strips. The preferred embodiment of the switch consists of a resilient casing with a cored central passage extending longitudinally of the casing and a pair of resilient metal contact strips mounted in spaced relationship in the cord passage, the contact strips having areas embossed to provide protuberances which are engageable with each other at a plurality of spaced contact points when the outer portion of said resilient casing is depressed.

This invention relates to electrical switches. More particularly it relates to electrical switches having ribbon-like metallic strips as contact members. Still more particularly, it relates to so-called momentary electrical switches in which the two metallic strips have contact areas raised thereon, so that when the strips are positioned in the enclosing flexible mounting, the raised areas are transversely positioned contact members.

Briefly, the apparatus of this invention comprises a switch which has a resilient casing with a cored central passage extending longitudinally of said casing and an outer longitudinal flexible portion depressible into said cored central passage, a pair of resilient metallic contact strips extending longitudinally of said cores central passage and mounted in spaced relationship therein, said resilient contact strips having areas embossed to provide protuberances of limited area relative to the surface areas of said strips, said embossed areas being oppositely disposed with said embossed areas extending angularly to each other in parallel planes, whereby the protuberances of said strips are engageable with each other at spaced contact points when said outer portion of said resilient casing is depressed.

Strip or ribbon type switches generally comprise two superimposed, relatively thin, flexible, electrically conductive strips held in spaced, out of contact relationship by insulating members. This type of switch has generally been restricted to use on electrical circuits having limited current or amperage requirements because heavy current loads may cause the flat metallic strips in use heretofore to burn at the contact area or to fuse, results which, even if the switch is not rendered entirely inoperative, leads to erosion and erratic current flow.

A typical use of the conventional momentary strip switches is as the actuating member of the control circuit for an electrical relay which actuates a switch of character adapting it to the current flow in the main electrical circuit. In automobiles, for example certain light duty momentary contact switches or strip switches control relays, which in turn control horns or other relatively high amperage devices. Such relays complicate the circuits and add appreciably to the cost of controlling electrical circuits.

Now it has been discovered that strip or ribbon switches can be produced which will meet reliability specifications when carrying directly certain currents

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for such uses as actuating automobile accessories, thus eliminating relays.

The present invention involves provision of a compact mechanism completely within a resilient casing, the resilient metallic contact strips having protuberances of limited area relative to the surface areas of the strips. The protuberances obtained by embossing to provide raised contact areas present unique advantages in that improved strength and rigidity are imparted to the resilient metallic sheets. In addition, working of the metal in the embossing operation creates hardness in the protuberances without appreciable change in the internal physical structure of the balance of the resilient metallic strip.

Size of the protuberances generally will depend upon the length thereof, the direction thereof relative to the longitudinal axis of the metallic strips and the width of the metallic strips. If the protuberances of one of the metallic strips are positioned at right angles to the longitudinal axis of the metallic strips, the length of the protuberances seldom exceed more than one-half the width of the strip, i.e., strips of $\frac{1}{4}$ inch width will have protuberances of about $\frac{1}{8}$ inch length. Such protuberances provide rigidity in the transverse direction while leaving the strip with flexibility in the longitudinal direction.

The height of such protuberances above the normal surface level of the strip will generally be in the range of one to two times the thickness of the metallic strip, although protuberances of greater height can be embossed if care is taken not to stretch the metal too thin.

Width of the protuberances may vary, the preferred width usually being approximately three to six times the height so that the protuberances will not be subjected to severe stressing.

Spacing of protuberances will depend upon the disposition angularly of the protuberances in the parallel planes. To meet specification for switch life expectancy, it is desirable that depression of the one metallic strip induce at least a two protuberance contact on the strip with multiple parallel protuberances. When the protuberances of the switch strips are positioned at right angles to one another, assuming a contact such as is produced by finger contact with the resilient casing, a spacing of approximately $\frac{1}{8}$ inch will usually provide such contact at two protuberances on the same metallic strip. It is preferable, of course, to make contact substantially simultaneously at more than one protuberance since this distributes the flow of current over a greater area and reduces any tendency to have arcing or burning. In addition, any eroding or wear of the multiple parallel protuberances by extensive use will allow the adjacent protuberances to take over the contacting function. Spacing for protuberances is generally of the order of $\frac{1}{8}$ inch to $\frac{5}{16}$ inch.

Protuberances are preferably semi-circular in cross-sectional configuration because the elimination of sharp edges minimizes the tendency of current to flow strongly from projecting points, a factor which would contribute to electrical arcing.

The advantage of protuberance contact area in extinguishing or suppressing arcing and burning may be seen from the following comparison. A pair of SAE 110 alloy spring temper copper strips of 0.005 inch thickness and $\frac{1}{4}$ inch width were mounted in a resilient casing to form a switch A. The flat strips were mounted so as to provide a contact gap of 0.006 inch. A second switch B was prepared using one flat strip and one strip with a protuberance running longitudinally of the strip.

A third switch C using copper strip of the same type as described above and embossed so as to provide one strip with a continuous protuberance running longitudinally of the strip and paired with a second copper strip

which was embossed to provide protuberances running at right angles to the longitudinal axis of the strip. The transverse protuberances had an approximate $\frac{1}{8}$ inch spacing and were approximately 0.005 inch in height. The two embossed strips were mounted in the resilient casing of a third switch C so as to provide a contact gap of 0.006 inch.

The switches were connected into an electrical circuit adapted for an inductive load of 12 amps current at 14 volts, i.e., the current to operate automobile horns. The switch was positioned so that a reciprocating ram with a convex curvature tip simulating a human finger would actuate and depress the resilient casing to activate the horns. The ram operated to provide twelve contacts of $2\frac{1}{2}$ seconds duration each per minute.

After switch A was operated for 3000 cycles, horn tones became erratic and examination of the switch showed a burn and deep erosion of approximately $\frac{1}{16}$ inch width extending longitudinally for a distance of about $\frac{1}{2}$ inch.

After switch B was operated for 3000 cycles, horn tones became erratic and examination of the switch showed a burn on the strip with longitudinal protuberance of about $\frac{3}{16}$ inch length and a deep erosion in the flat strip.

After switch C, a switch having the novel construction of this invention, was operated for 3000 cycles, only a slight bluish discoloration was apparent at the spaced contact areas, at the end of 5000 cycles only a slight change in discoloration was apparent and the horns still operated with consistent tones showing that the circuit still carried full current without interference in the switch contact areas.

The capabilities of the invention will be apparent to those skilled in the art from the following description of a preferred embodiment thereof taken in conjunction with the accompanying drawings:

FIGURE 1 is a perspective view of a switch with part of the casing broken away and the top metallic contact strip lifted to show the relationship of protuberances or ribs;

FIG. 2 is a side elevational view of the bottom metallic strip shown in FIG. 1;

FIG. 3 is a plan view of a contact strip adapted for edgewise flexibility;

FIG. 4 is a sectional view through a part of a two-piece steering wheel showing the ribbon and contact strips in place;

FIG. 5 is a plan view of a steering wheel with switch in place at the inner periphery and showing its use as a horn blowing switch; and

FIG. 6 is a sectional view of a one-piece steering wheel with slots arranged therein so that the lips of the casing formed as an extrusion can be snapped into place.

As shown in FIGS. 1 and 2 the switch member 10 is made up of a pair of contact strips 11 and 12 mounted in the cored position 13 of a resilient tubular-like casing member 14.

Extending from the sides of cored portion 13 of casing member 14 are pairs of slit members 15 and 16 which are continuous over the length of the casing. Slit members 15 provide a support means for upper contact strip 11 and slit members 16 provide a support means for the lower contact strip 12.

Metallic strip 11 is provided with an embossed longitudinally extending rib 17 generally positioned at or adjacent the central longitudinal axis of said strip. This strip 11 is mounted in slit members 15 with rib 17 extending in the direction of contact strip 12.

Lower metallic strip 12 is mounted in slits 16 with the parallel protuberances 18 extending toward the upper metallic strip 11.

The back portion 20 of resilient casing member 14 may be of any suitable configuration, i.e., curved or straight, depending upon the mounting position. The

front face 21 of the casing member 14 is formed to provide a cushion which requires a certain degree of pressure before the cushion is sufficiently depressed to bring longitudinal rib 17 into contact with protuberances 18. Internally the casing 14 is provided with relieved areas 22 which contribute to less cross-sectional area flexing of the casing during cold weather.

Resilient casing member 14 is formed of a non-conducting resilient material such as natural rubber, synthetic elastomers, vinyl resins and the like. The material utilized is generally chosen on the basis of its resiliency remaining reasonably constant and relatively insensitive to temperature changes. In manufacture, the casing preferably is made by a continuous extrusion process. The extrusion may be formed with metallic strips in place or formed separate for later insertion of the contact strips 11 and 12. After the metallic strips 11 and 12 are inserted into casing 14, and a piece of a length desired for the intended use is cut off, lead wires are attached by suitable means as by soldering and the ends of the cored passage are closed by the suitable insulating material.

FIG. 3 illustrates a second form of metallic contact strip which may be substituted for, for example, contact strip 12. The modified contact strip comprises central portions 23 alternately positioned and a series of supporting bridge portions 24 which run substantially perpendicular to the major axis of the strip formed by making a plurality of aligned cut-out portions 25. Bridge portions 24 have embossed into them the protuberance or rib members 26. Such an arrangement of cut-out portions 24 enables the strip to have a high degree of multiple plane flexibility whereby it easily follows curved contours of a mounting surface.

Referring to FIGS. 4 and 5, the switch is shown mounted on an automobile steering wheel 30. Steering wheel 30 comprises two portions 31 and 32 supported by a steel core 33. The portion 31 is provided with a lip 35 and the portion 32 with a lip 36. When portions 31 and 32 are adhered into a unitary structure, a T-shaped slot 34 is provided around the inner periphery of the wheel 30, although such slot may be positioned at any suitable location, as at the outer periphery, and the like. Mounted in slot 34 is switch 37, the casing portion 38 of which is formed with shoulders 39 and 40 adapted to contact the inner surface of lips 35 and 36, respectively, to lock the casing 38 in place. Casing 38 is, as described previously, a resilient tubular-like member with a cored portion in which the contact members 41 and 42 of the type illustrated in FIGS. 1 and 2 are mounted.

Casing 38 is shown in a replacement form with tapered surfaces 43 and 44 extending from the shoulders 39 and 40, respectively, to a flat base 45. Such tapered shoulders facilitate insertion of the switch into the wheel if necessary after formation of the unitary structure.

Referring to FIG. 6, the switch member 46 is of a type having a casing 47 designed for attachment to a molded one-piece steering wheel 48. Casing 47 is a composite unit of a rigid portion 49 fused, as at the time of extrusion to a resilient, flexible portion 50 which is the cored portion designed to receive the flexible metallic contact members 51 and 52. Such a dual durometer unit may be latched into position in a steering wheel in numerous ways.

In the embodiment of FIG. 6, rigid portion 49 of the composite unit is provided with a lip 53 adapted to cooperate with recess 54 in wheel 48. In embodiments where an adhesive is to be used to permanently lock a lip such as lip 53 into place, the configuration of the lip may be modified so that the lip does not completely fill recess 54 and room is thereby provided for liquid plastic or adhesive that will solidify and form a bond, or provide a bond to the wheel while forming a mechanical lock to the switch casing. Resilient, flexible portion 50 of the composite unit is provided with a lip 54 adapted to cooperate with recess 56 in wheel 48 so that when the composite

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unit has the lips seated in the recesses, the switch is securely locked to the steering wheel. Adhesives may be employed to further the joining of switch and wheel.

FIG. 5 illustrates a switch 10 in operation. By applying pressure to bring rib 17 and protuberances 18 into contact completes a circuit from a power source such as an automobile battery to conductors 57 and 58 to operate an accessory 59 such as automobile horns.

The particular arrangement of installing the switching means on a suitable base and of connecting it to suitable electrical conductors systems, depends of course on the particular base structure encountered. Furthermore, while the preferred form for connecting the switch to the electrical circuitry is discussed herein, the use of other connecting means is contemplated within the scope of this invention.

The above-detailed description of this invention has been given by way of illustration without any intention that the invention be limited to the exact conditions set forth. No unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

We claim:

1. A switch comprising a resilient casing having a cored central passage extending longitudinally of said casing and an outer longitudinal flexible portion depressible into said cored central passage, a pair of resilient metallic contact strips extending longitudinally of said cored central passage and mounted in spaced relationship therein, said resilient contact strips having areas embossed to provide protuberances of limited area relative to the surface areas of said strips, said embossed areas being oppositely disposed with said embossed areas extending angularly relative to each other in parallel planes, whereby the protuberances of said strips are engageable with each other at spaced contact points when said outer portion of said resilient casing is depressed.

2. A switch as described in claim 1 wherein the first of said resilient contact strip is embossed with a protuberance in the form of a longitudinally extending rib and the second of said resilient contact strips has a multiplicity of protuberances embossed in positions transverse to said longitudinally extending rib of said first contact strip.

3. A switch as described in claim 2 wherein the embossed protuberances on the other of said resilient contact strips are equally spaced and positioned at right angles to said longitudinal rib of said first strip.

4. A switch as described in claim 2 wherein the protuberances on the other of said resilient contact strips have a spacing in the range between $\frac{1}{16}$ and $\frac{5}{16}$ of an inch.

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5. A switch as described in claim 2 wherein said resilient contact strips are provided with spaced cutout portions and the protuberances positioned transverse to said longitudinally extending rib are embossed in the area between slits.

6. A steering wheel with mounted momentary switch for actuation of automobile accessories comprising a resilient ribbon annularly mounted on the steering wheel rim and having a hollow longitudinal passage extending substantially the length thereof, said passage being of substantially rectangular cross section and having substantially parallel longitudinal slits extending from each cross-section corner, a front cushion portion along the length of said ribbon, and a pair of electrical contact strips, each approximating the length of said passage and comprising a pair of resilient metallic contact strips mounted in spaced relationship in said passage, said resilient contact strips having areas embossed to provide protuberances of limited area relative to the surface areas of said strips, said embossed areas being oppositely disposed with said embossed areas extending angularly relative to each other in parallel planes, whereby the protuberances of said strips are engageable with each other at spaced contact points when said front cushion portion of said ribbon is depressed.

7. A steering wheel with mounted momentary switch as described in claim 6 wherein said switch is mechanically latched in position by an adhesive.

8. A steering wheel with mounted momentary switch as described in claim 6 wherein said wheel is formed by latching together two portions adapted to provide a recess in which said switch is latched.

9. A steering wheel with mounted momentary switch as described in claim 6 wherein said wheel is a unitary member provided with a recess and the dual durometer casing is provided with shoulders adapted to mechanically latch said switch in said recess.

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