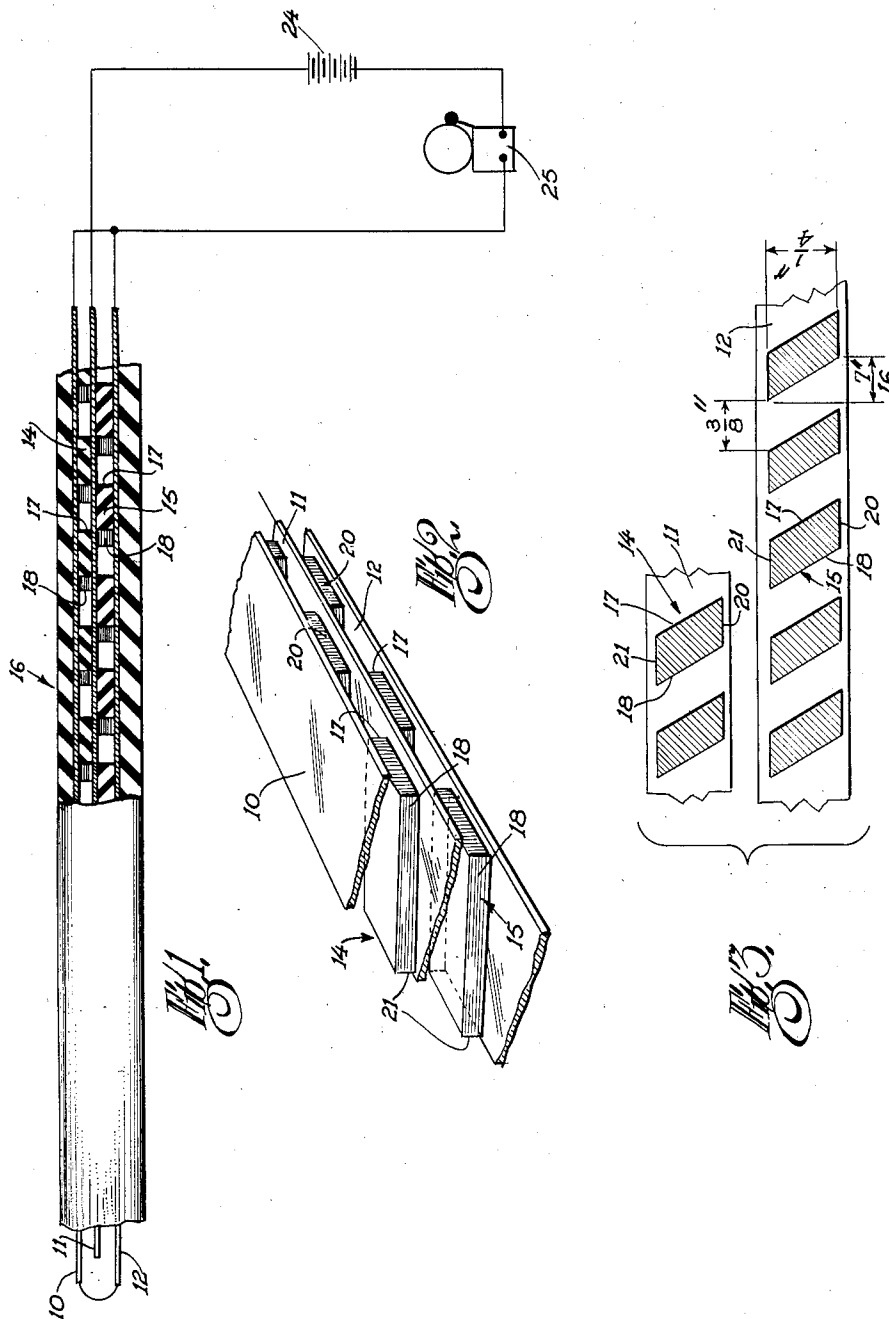


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W. T. FLEMING
DEFORMATION SWITCH
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DEFORMATION SWITCH

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9 Claims. (Cl. 200—86)

The present invention relates to electrical circuit makers, and, more particularly, to a deformable switch which is operable by being compressed at any point along its length.

Specifically, the present invention relates to such switches which are an improvement over the deformable switch disclosed in copending application for United States Patent No. 2,728,827.

The switch disclosed in the aforementioned patent generally comprises first, second and third elongate, superimposed, flexible, electrically conductive strips; a series of lengthwise spaced insulating elements for normally holding the first and second strips out of contact with each other; a second series of lengthwise spaced insulating elements for normally holding the second and third strips out of contact with each other; and a tubular, deformable, nonconductive housing for the strips. The elements of the first and second series are staggered lengthwise with respect to each other, so that, when the switch is connected in a circuit, with the first and third strips in electrical connection, there are no dead spots along the entire length of the switch because either the first strip or the third strip will contact the second strip to close the circuit upon application of pressure at any point along the length of the strips.

While the switch just described can be advantageously utilized for many purposes, it has been found that the very light operating pressure required to close the circuit is not desirable in some instances.

Accordingly, an object of the present invention is to provide a switch of the foregoing type which is operable only by a much heavier pressure without materially increasing the weight, the size or the cost thereof.

Another object is to provide such a switch which is stiffened by arranging the strip spacer elements in a novel manner.

A further object is to provide such a switch which is simple, economical and durable.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects are accomplished by providing a switch assembly which comprises first, second and third elongate, superimposed, flexible, electrically conductive strips; a series of lengthwise spaced insulating elements or pads for normally holding the first and second strips out of contact with each other, having crosswise extending edges; a second series of such elements for normally holding the second and third strips out of contact with each other, the elements of the first and second series being staggered lengthwise with respect to each other and being in close proximity or in overlapping relation at the crosswise extending edges thereof; and a tubular, deformable, nonconductive housing for the

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strips. Preferably, the pads have two parallel edges which extend obliquely across the strips, the pads being generally rhombic in shape and compressible, so that there are no dead spots along the entire length of the assembly.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Fig. 1 is a fragmentary side elevational view, partly in section, illustrating a switch assembly, in accordance with the invention, connected in an alarm circuit.

Fig. 2 is a fragmentary perspective view of the strips and spacer pads of the assembly apart from the housing.

Fig. 3 is a schematic view illustrating the arrangement of the pads of one series with respect to the pads of the other series.

Referring to the drawing in detail, there is shown a switch assembly generally comprising three superimposed metallic strips 10, 11 and 12, a series of elements 14 for normally holding the strips 10 and 11 out of contact with each other, a second series of elements 15 for normally holding the strips 11 and 12 out of contact with each other, and a tubular housing 16 for the strips.

The strips 10, 11 and 12 are formed of electrically conductive material, such as copper or the like, and are relatively thin and flexible. For example, these strips have a width of about one quarter of an inch and a thickness of about ten thousandths of an inch.

The elements 14 and 15 are small pads of suitable insulating material such as rubber or a rubber composition which is compressible, and have a thickness of about one sixteenth of an inch. These pads are adhesively secured to one or both of the strips held apart by them.

As shown herein, the pads preferably are generally rhombic in shape. The pads have parallel leading and trailing edges 17 and 18 extending crosswise obliquely with respect to the strips, and have parallel side edges 20 and 21 adjacent and parallel to the side edges of the strips. In the illustrative embodiment, the edges 20 and 21 have a length of about three eighths of an inch, and the edges 17 and 18 are at an angle of about 60° to the edges 20 and 21, respectively.

The pads of both series are spaced lengthwise equidistantly to provide a space between adjacent pads identical to the shape and surface dimensions of the pads. The pads 14 and 15 are arranged in staggered relation with respect to each other, so that the pads 14 overlie the spaces between the pads 15 and the spaces between the pads 14 overlie the pads 15. In this manner, the leading edges of the pads 14 are in alignment with the trailing edges of the pads 15, and the leading edges of the pads 15 are in alignment with the trailing edges of the pads 14. However, it is not required that the aforementioned edges are exactly in alignment as specified, because the advantages of the present invention can be attained even if these edges are spaced apart about one thirty-second of an inch or overlap about one thirty-second of an inch, the important feature being that they are in close proximity.

When the pads are dimensioned and arranged as just described, the leading edges 17 at the side edges 20 are slightly in advance of the trailing edges 18 at the side edges 21 of an adjacent pad.

The housing 16 has a rectangular bore for snugly receiving the strips and the pads positioned therebetween. Preferably, the housing is formed of insulating material such as rubber or a rubber composition which is readily deformed, provides a watertight seal about the strips, and is weather resistant at temperatures between about -65° F. and about 160° F.

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The switch assembly is adapted to be used in an alarm circuit, including a source of energy 24 and alarm means, such as a bell 25. In this circuit, the strips 10 and 12 are electrically connected to each other at one or both ends thereof and to one terminal of the bell, the strip 11 is connected to one pole of the source, and the other terminal of the bell is connected to the other pole of the source, so that, upon establishing contact between the strip 11 and the strip 10 and/or the strip 12, the circuit is closed and the bell is energized.

While the strips and pads are constructed of readily yieldable, lightweight, small dimensioned parts, the arrangement of the pads in accordance with the invention requires that a considerable compression force be applied in a vertical direction (as viewed in Fig. 1) to close the circuit in the manner just described. For example, experiments indicated that a force of about 150 p. s. i. was required. This force is about ten times that of the force required to operate the switch assembly disclosed in the copending application referred to herein. Other experiments indicated that the switch assembly has no dead spots, in spite of a very slight overlap between the leading and trailing edges of the respective series of pads and the leading edges being in advance of the trailing edges of adjacent pads in each series. These features appear to produce an arrangement requiring the higher force to bring adjacent strips into contact without creating dead spots.

From the foregoing description, it will be seen that the present invention provides a practical and reliable switch assembly which is simple and small but yet requires a substantial force to operate the same.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. A switch assembly comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced insulating elements for normally holding said first and second strips out of contact with each other having crosswise extending edges; a second series of lengthwise spaced insulating elements for normally holding said second and third strips out of contact with each other having crosswise extending edges, said elements of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and said edges of said elements of said first series being in close proximity to said edges of said elements of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

2. A switch assembly comprising first, second and third elongate, superimposed flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced insulating elements for normally holding said first and second strips out of contact with each other having oblique crosswise extending edges; a second series of lengthwise spaced insulating elements for normally holding said second and third strips out of contact with each other having oblique crosswise extending edges, said elements of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and said edges of said elements of said first series being in close proximity to said edges of said elements of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

3. A switch assembly comprising first, second and third elongate, superimposed, flexible, electrically conductive

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strips of indefinite, continuous length; a series of lengthwise spaced insulating elements for normally holding said first and second strips out of contact with each other having oblique crosswise extending edges; a second series of lengthwise spaced insulating elements for normally holding said second and third strips out of contact with each other having oblique crosswise extending edges, said elements of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and said edges of said elements of said first series being in overlapping relation with said edges of said elements of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

4. A switch assembly of the class described comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced insulating pads between said first and second strips for normally holding the same out of contact with each other; a second series of lengthwise spaced insulating pads between said second and third strips for normally holding the same out of contact with each other, said pads having two pairs of parallel sides with one pair parallel to the sides of said strips and the other pair extending crosswise with respect to said strips, said pads of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and with said crosswise extending edges of said pads of said first series being in close proximity to said crosswise extending edges of said pads of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

5. A switch assembly of the class described comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced insulating pads between said first and second strips for normally holding the same out of contact with each other; a second series of lengthwise spaced insulating pads between said second and third strips for normally holding the same out of contact with each other, said pads having two pairs of parallel sides with one pair parallel to the sides of said strips and the other pair extending crosswise with respect to said strips, said pads of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and with said crosswise extending edges of said pads of said first series being in overlapping relation with said crosswise extending edges of said pads of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

6. A switch assembly of the class described comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced insulating pads between said first and second strips for normally holding the same out of contact with each other; a second series of lengthwise spaced insulating pads between said second and third strips for normally holding the same out of contact with each other, said pads having two pairs of parallel sides with one pair parallel to the sides of said strips and the other pair extending diagonally crosswise with respect to said strips, said pads of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and with said crosswise extending edges of said pads of said first series being in close proximity to said crosswise extending edges of said pads of said second series; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

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7. A switch assembly comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced, generally rhombic, compressible insulating pads for normally holding said first and second strips out of contact with each other having crosswise extending edges; a second series of lengthwise spaced, substantially rhombic, resilient insulating pads for normally holding said second and third strips out of contact with each other having crosswise extending edges, said pads of said first and second series being staggered lengthwise with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips and having portions adjacent said edges in overlapping relation; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

8. A switch assembly of the class described comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced, generally rhombic, compressible insulating pads for normally holding said first and second strips out of contact with each other; a second series of identical pads between said second and third strips for normally holding the same out of contact with each other, said pads of both series having a space between adjacent pads substantially identical to the shape and dimensions of said pads with said pads of said first and second series being staggered with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips whereby the pads of said first series overlies the spaces of said second series and the spaces of said first series overlies said pads of said second series; and a tubular, de-

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formable, nonconductive housing of indefinite, continuous length for said strips.

9. A switch assembly of the class described comprising first, second and third elongate, superimposed, flexible, electrically conductive strips of indefinite, continuous length; a series of lengthwise spaced, generally rhombic, compressible insulating pads for normally holding said first and second strips out of contact with each other; a second series of identical pads between said second and third strips for normally holding the same out of contact with each other, said pads of both series having an oblique leading edge and an oblique trailing edge and having a space between adjacent pads substantially identical to the shape and dimensions of said pads with said pads of said first and second series being staggered with respect to each other and extending from adjacent one side edge to adjacent the other side edge of said strips whereby the pads of said first series overlies the spaces of said second series and the spaces of said first series overlies said pads of said second series, said oblique edges being of a length and inclined at an angle so that the leading edge of a pad in one series at one side edge of said second strip is in advance of the trailing edge of an adjacent pad in the said series at the opposite side edge of said second strip; and a tubular, deformable, nonconductive housing of indefinite, continuous length for said strips.

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