March 7, 1967 J. E. THOMPSON 3,308,257

MINIATURE INDICATING FUSE

Filed Oct. 23, 1965 2 Sheets-Sheet 1

FIG. 5

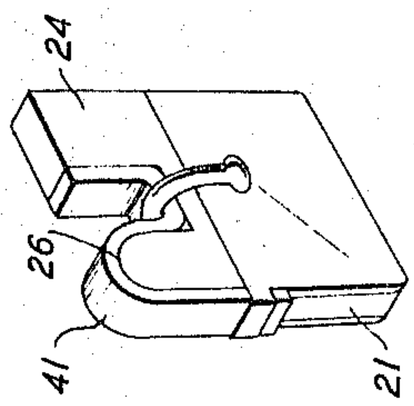


FIG. 9

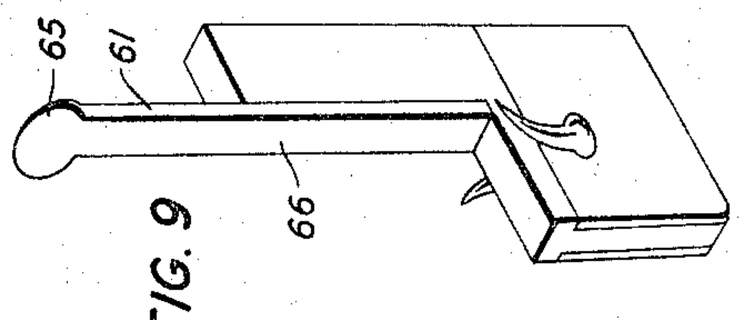


FIG. 4

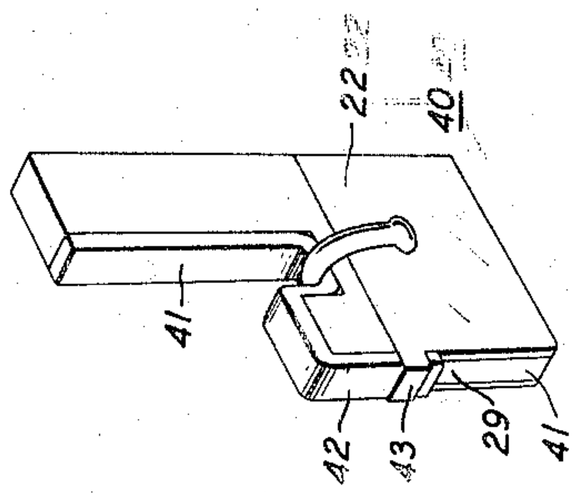


FIG. 8

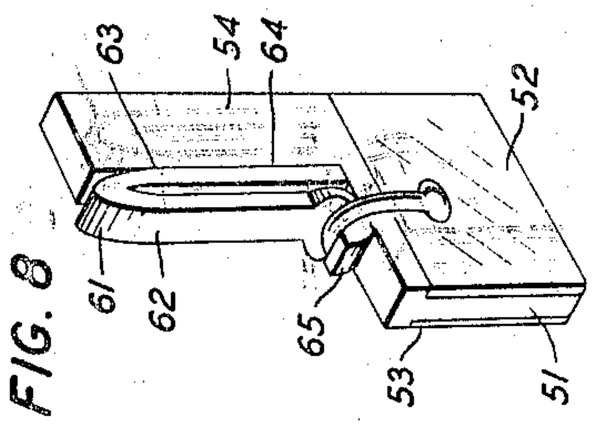


FIG. 2

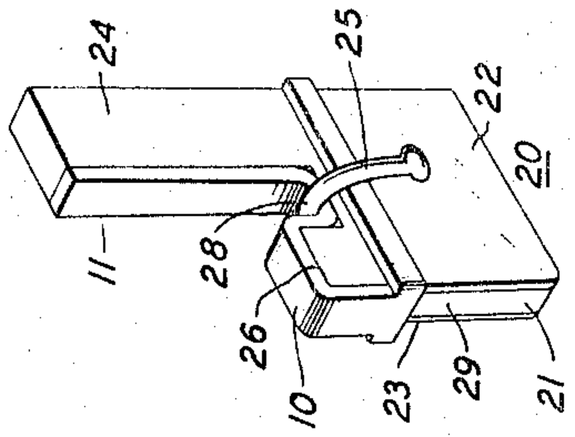


FIG. 7

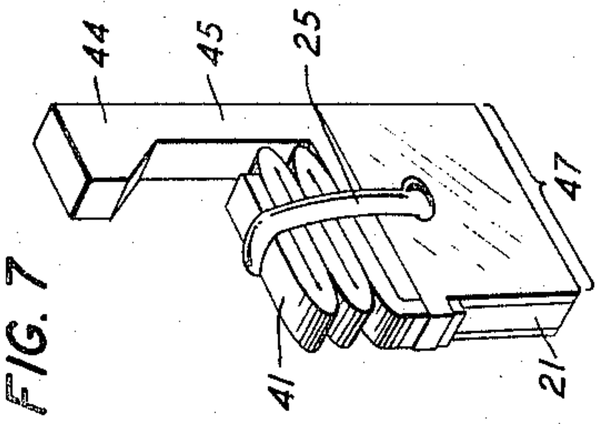


FIG. 1B

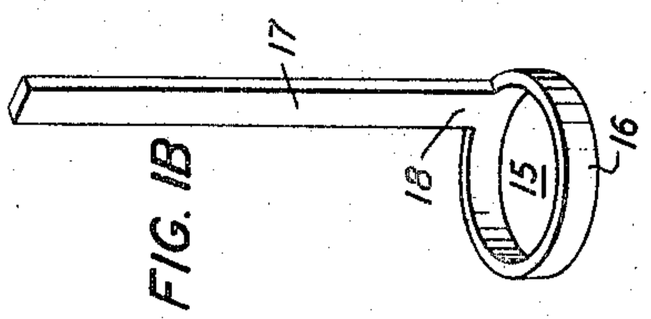
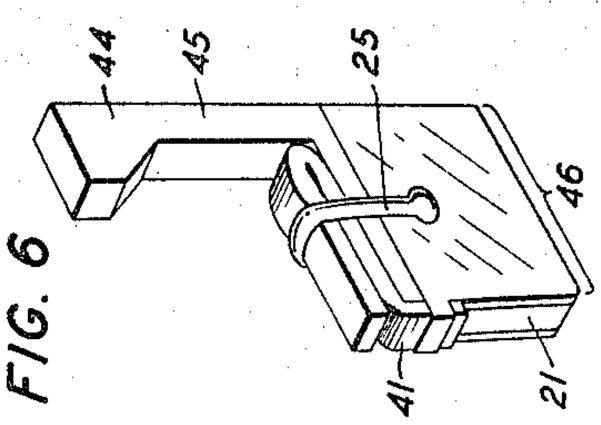


FIG. 1A

FIG. 6



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MINIATURE INDICATING FUSE

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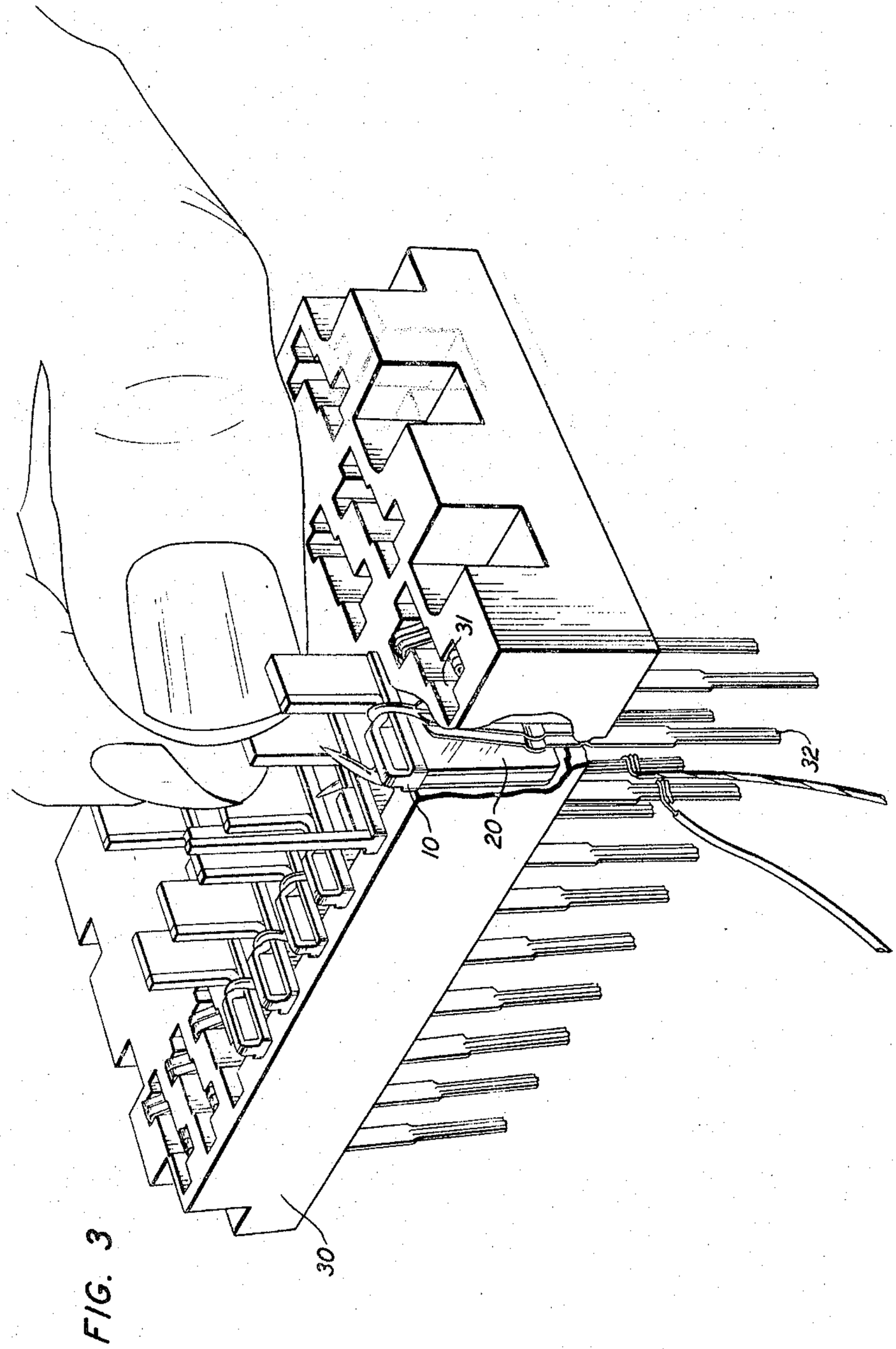

FIG. 3

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MINIATURE INDICATING FUSE

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9 Claims. (Cl. 200—123)

This invention relates to electrical fuses and in particular to a novel structural arrangement for a miniature indicating fuse.

In almost all segments of the electronics industry the needs are increasingly acute for ever smaller components and complete electrical systems. Understandably, miniaturization work has concentrated on the critical, high usage circuit elements and as a result a large variety of extremely small components, active and passive, are now routinely employed. Not all circuit elements, however, have been miniaturized successfully, and consequently some type of modules and equipment requiring these elements necessarily have remained bulky. Of the remaining few components which, for one reason or another have defied miniaturization, the simple indicator fuse has presented perhaps the most vexing assortment of problems.

A major impasse in the miniaturization of indicator fuses has been that the reduced-size visual indicator element does not stand out or readily draw attention. A related concern is the mechanical reliability of these fuses, which is sometimes sacrificed with any significant size reduction. Another problem involves the leaf or coil spring normally used to release a warning mechanism of some sort when the fuse blows. These springs are rather expensive and in the smaller sizes tend to be delicate.

Accordingly, an object of the invention is to reduce substantially the size, bulk and weight of indicator fuses.

Another object of the invention is to increase the reliability of such fuses.

A further object of the invention is to simplify the structure of indicator fuses without decreasing their reliability.

A still further object of the invention is to make the indicator element more easily seen.

These and other objects of the invention are achieved, broadly, by employing as the indicator element a resilient strip such as nylon or other plastic that springs erect from a position of confinement in which it is held in restraint by the fusing element until the latter burns out.

In accordance with one embodiment of the invention, the body of the indicator fuse comprises a thin mounting board with opposed electrical terminals on the sides and a tab extending up from one end of the board. The tab serves as a finger grip for the fuse; and its inner edge and the adjacent top edge of the board provide a seat for the indicator element. This element is produced as an elongated, narrow and normally straight strip. One end of the strip is rigidly supported on a selected surface of the board that is situated substantially in the plane which the strip is to occupy when in the indicating position. This surface may be one opposite the tab base in which case, to impart a spring tension to the strip, the latter is bent down flush against the top edge of the board and the tab inner edge. The strip is retained in this position by the fusing element connected across the top edge between the fuse terminals. Pursuant to the invention, when a current overload causes burn-out of the fuse element, the strip is released and springs erect, well above and away from the tab.

The manner of supporting the strip's end on the fuse body may be varied to suit specific considerations of

cost and design. For example, the indicator strip may comprise the center leg of a flat T, the outer legs of which are secured against respective sides of the body and in turn support the crosspoint of the T in the desired plane. Alternatively, the indicator element may be an extension leg of a resilient, closed loop that stretches around the fuse body and holds the leg in the desired position. Further methods for supporting the indicator are described below.

In accordance with another aspect of the invention, the indicator strips may be made in various specific colors, each color denoting, for example, a separate type of circuit, a separate current or voltage rating, or some other fact of significance.

In accordance with a further aspect of the invention, the indicator strip may be so retained on the fuse body that a surface of the strip is connected until the fuse element burns out. A suitable radiant energy-sensitive coating may be applied to this surface so that when the element springs erect and exposes same, the presence of the chosen energy will cause the element to glow. Burnout of this fuse, even in a large grouping, can be detected visually almost at once.

Accordingly, a feature of the invention resides in the use of a narrow resilient strip such as nylon or other plastic, as the indicator element of an indicating fuse.

A further feature of the invention relates to the retention by the fusing element itself of an indicator strip in a position of restraint along an edge of the fuse body until overload occurs.

A further feature of the invention lies in a fuse indicator strip formed of material that is both resilient and producible in numerous colors.

These and other objects and features of the invention are described in greater detail in the following illustrative embodiments thereof and in the drawing in which:

FIGS. 1A and 1B are perspective views of two possible embodiments of the indicator element;

FIG. 2 is a perspective view of an indicator element mounted on a fuse;

FIG. 3 is a perspective view of several such fuses in a fuse block;

FIG. 4 is a perspective view of an alternative indicator element;

FIG. 5 is a perspective view of an alternative fuse body;

FIGS. 6 and 7 are perspective views of two further variations of the indicator element; and

FIGS. 8 and 9 are perspective views of an additional variation of an indicator element.

FIG. 1A illustrates one embodiment of the novel indicator element. A unitary element **10** is shown comprising a center leg **11**, a left leg **12** and a right leg **13**. Advantageously, element **10** is formed in the shape of a flat T as shown in FIG. 1, of a relatively resilient springy electrically insulating material such as nylon, polysulfone or polyvinylchloride. In this embodiment, center leg **11** functions as the indicator in a manner to be described, while legs **12** and **13** are supportive.

FIG. 2 shows a complete indicator fuse, designated as **20**, with element **10** installed and retained in its nonindicating mode. Fuse **20** comprises a slim nonconductive mounting board or body **21**, wafer-like in shape, with electrical contact surfaces **22** and **23** disposed on opposite sides of board **21**, a gripping tab **24** formed by an extension of board **21** and a fusing element **25** connected between surfaces **22** and **23**. Indicator element **10** is mounted upon board **21** with its crosspoint **14** positioned near the top of a first end thereof, opposite tab **24**. Legs **12** and **13** are bent back and retained flush against opposite sides of board **21** by a suitable adhesive. Indicator leg **11** is deflexed onto top edge **26** of board **21** and the

inner edge **27** of tab **24**, retained under stress by element **25**. A recess **28** in top edge **26** may be employed to good advantage to increase the overall length of indicator leg **11** and to give it greater springiness.

FIG. 3 illustrates one practical mounting method for the novel indicator fuses. Shown therein is a connector block **30** and several fuses of the kind described above. Block **30** is a connector for mounting a large number of insertable elements. Each fuse **20** is retained in a separate fuse recess **31** between a pair of oppositely disposed spring contacts **32**. The indicator leg **11** of one of the fuses is shown in the erect, indicating position pursuant to the invention, just after its fusing element **25** has burned out. Leg **11** reverts to this, its normal, position due to the bending moment produced at the crosspoint **14** during its mounting on fuse body **20**. Indicator leg **11** affords a very clear identification of the blown fuse, since it stands away from and above board **21**.

FIG. 1B shows an alternative indicator element structure in which the element, designated **15**, comprises a resilient loop **16**, a leg **17**, and a juncture **18** between leg and loop, formed of the same material as suggested above for element **10**. Element **15** is installed on a fuse such as fuse **20** by stretching loop **16** over body **21** so that juncture **18** is situated in the same position on body **21** as the crosspoint of element **10**, shown in FIG. 2.

Pursuant to another aspect of the invention, element **10** or its varieties to be described may be produced by well-known processes in various colors at no appreciable added cost. Numerous useful color code schemes become possible as, for example, for identifying fuse amperage ratings to help insure replacement with the correct type fuse. As an alternative, the color coding applied to the indicator element can identify different circuits, or where desired, establish a range of relative importance for the various fused circuits.

Shown in FIG. 4 is another indicator fuse made pursuant to the invention. This fuse, designated as **40**, is similar in construction to those shown in FIG. 3, except that the legs **12** and **13** shown in FIG. 1 have been omitted. In this embodiment the indicator element comprises a single leg **41** with a lower portion **42** that is secured to the front edge **29** of mounting board **21**. One method of securing lower portion **42** is with a tabular extension **43** of electrical contact surface **22**. Another securing method involves cementing lower leg portion **42** to front edge **29** with a bonding adhesive such as epoxy.

FIG. 5 illustrates a further embodiment of the invention in which the tab **24** of body **21** is reduced in height to conserve space. The indicator element **41** is of the same configuration as shown in FIG. 4, and the mounting thereof upon body **21** is also the same. So that the indicator leg will reach as high in its erect position as occurs in the above embodiments, the top edge **26** of body **21** may be raised to the height of tab **24**.

FIG. 6 illustrates a further variation of the inventive concept, featuring here a mounting board **21** in which the recess, for example, element **28** of FIG. 2, has been eliminated. The indicator element **41**, which here is substantially the same as that shown in FIG. 4, is doubled over upon itself and retained under stress by the usual fuse element **25**. A tab designated as **44** is included as part of body **21**, but has a thin shank section **45** to allow more room for seating of the indicator **41** in the position shown. This arrangement has the advantage that less of the indicator **41** is actually in contact with the body **21**. Accordingly, the possibility of ambient operating conditions causing indicator **41** to become stuck to body **21** is lessened.

A variation of the inventive concept illustrated in FIG. 6 is depicted in FIG. 7, in which the fuse structure includes an indicator element **41** that is doubled over upon itself several times. In accordance with this aspect of the invention, this structure enables the length of the fuse to be decreased while still achieving the advantages of the

structure shown in FIG. 6. By retaining indicator **41** in a pile-up instead of in a single-fold, the same length of indicator may be situated on a smaller seat. Hence, the zlength **47** of the FIG. 7 fuse can be less than the corresponding length **46** of the FIG. 6 fuse without forfeiting any indicator length. The structure shown in FIG. 7 may offer benefits when space is especially tight.

FIGS. 8 and 9 illustrate a further variation of the invention, both in body structure and importantly in the positioning of indicator element **61**. As shown in FIG. 8, a fuse body **51** includes a pair of contact surfaces **52**, **53** and a tab extension **54**. Indicator element **61** includes a lower portion **63** that is cemented or otherwise affixed to the inner edge **64** of tab **54** and an upper portion **62**. A fusing element **55** connects contact surfaces **52** and **53**, and holds element **61** in the nonindicating position by impinging upon a distended end portion **65** of element **61**.

When element **55** burns out, the end portion **65** of indicator element **61** is released. The stresses in element **61**, produced when leg **62** was doubled over upon lower portion **63** during mounting, cause leg **62** to stand erect. FIG. 9 portrays indicator element **61** in its indicating position. A further advantage is derived by shaping end portion **65** in the form of a nub that can be seen even more readily than the element itself. Of course, the nub structure may be used also in any of the indicator element embodiments already described.

In accordance with an important aspect of the invention, a further improvement in the indicating capabilities of the fuse may be achieved by coating the entire surface **66** of element **61** with some type of radiant energy-sensitive material. For example, surface **66** may be thinly coated with a material such as a fluorescent dye that is sensitive to ultra-violet light. One such dye is Calcofluor yellow, made by American Cyanamid Company. An alternative coating is zinc sulfide that is sensitive to infrared light. A third possible coating, known in the trade as Violite, is suitable with ultra-violet light. As long as element **61** is in the nonindicating position shown in FIG. 8, the surface **66** will be hidden. However, when the fuse blows and element **61** springs erect, the entire surface **66** will become visible. By coating surface **66** as described, it is possible to identify very quickly the location of a blown fuse even in a grouping of thousands of fuses, simply by playing the appropriate light into the fuse compartment. Thus, the darkness normally engulfing most fuse compartments and hampering spotting in effect is turned to advantage pursuant to this aspect of the invention.

Various other modifications may be made by persons skilled in the art to the embodiments described, without departing from the spirit and scope of this invention; and it is to be understood expressly that all such modifications fall within the contemplation of the claims to follow.

What is claimed is:

1. An electrical fuse comprising a body with an end tab extending from the top edge thereof and a pair of electrical contacts with a fusing element therebetween, and means for indicating a burn-out of said fusing element comprising an elongated resilient member having a normally linear shape when under no stress, said member comprising an indicator element, means attaching an end of said member to an edge of said body remote from said tab, and means including said fusing element securing the remainder of said indicator element in a distended position flush with the inner edge of said tab and also the adjacent upper edge of said fuse body, said fusing element releasing said indicator element upon burn-out, whereby said indicator element springs erect to signal a blown fuse.

2. An electrical fuse comprising a slim body with an end tab extending from the top edge thereof, a pair of electrical contacts mounted on said body with a fusing element connected therebetween, and means for indicating a burn-out of said fusing element comprising an elongated resilient member having a normally straight shape when

under no stress, means attaching an end of said member to an edge of said body, and means including said fusing element for securing the remainder of said resilient member in a constrained position upon said fuse body top edge, said indicator element being bent back upon itself at least once, said fusing element releasing said indicator element upon burn-out, whereby said indicator element springs erect to signal a blown fuse.

3. An electrical fuse comprising a slim body with an end tab extending from the top edge thereof, a pair of electrical contacts mounted on said body with a fusing element connected therebetween, and means for indicating a burn-out of said fusing element comprising an elongated resilient member having a normally linear shape when under no stress, means attaching a first end of said member opposite the inner edge of said tab, and means including said fusing element securing the second end of said resilient member in a position adjacent said first end thereby to create a bending moment in said element, said fusing element releasing said second end upon burn-out, whereby said indicator element springs erect to signal a blown fuse.

4. An indicator fuse in accordance with claim **1** wherein said second end of said resilient member further comprises a nub, said fusing element securing said nub thereby to maintain said bending moment in said member until burn-out.

5. An electrical fuse comprising a flat, relatively slim body with a protruding tab extension at an end of its top edge, a pair of electrical contacts mounted on said body with a fusing element connected therebetween, and means for indicating a burn-out of said fusing element comprising a three-legged resilient member having a normally flat shape when under no stress, means securing two adjacent legs of said member against respective sides of said fuse body, means including said fusing element securing under stress the third leg against the top edge of said body and the adjacent inner edge of said tab, whereby when said fusing element burns out said third leg is released and springs erect, thereby to signal a blown fuse.

6. An electrical fusing system comprising a wafer-like body including electrical terminals mounted on opposite sides thereof and a top edge thereto, a fusing element extended over said top edge and connected between said terminals, an elongated resilient strip, means mounted on said body including a first end of said strip for supporting said strip on said body in an upright position with respect to said top edge thereby defining an indicating mode, a selected surface of said strip being exposed in said mode, said surface comprising a coating of radiant energy-sensitive material, means including said fusing element for deflexing said strip to a restrainted position defining a nonindicating mode, said selected surface being concealed in said mode, and means for applying said radiant energy to said fuse, said fusing element releasing said strip upon burn-out, whereby said strip springs upright exposing said coated surface to said radiant energy, said strip glowing in response thereto, to signal a burned fuse.

7. A fuse in accordance with claim **6** wherein said radiant energy-sensitive material comprises a fluorescent dye and said radiant energy comprises ultraviolet light.

8. A fuse in accordance with claim **6** wherein said radiant energy-sensitive material comprises zinc sulfide and said radiant energy comprises infra-red light.

9. A fuse in accordance with claim **6** wherein the color of said resilient means is selected in accordance with a predetermined color coding scheme, each color denoting a separate, prescribed fact concerning said fuse.

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