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(54) Fuse assembly

(57) A fuse assembly is provided, comprising a main fuse element; an indicator fuse element, arranged electrically in parallel with the main fuse element; and an indicator assembly. The indicator assembly comprises an indicator movable between a first position and a second position, a biasing means biasing the indicator to the second position, and the indicator being retained in the first position by the indicator fuse element against the action of the biasing means. The biasing means is may be a helical spring or an arrangement of opposing leaf spring elements. Melting of the indicator fuse element releases the indicator for movement from the first position to the second position, the biasing element acting to provide a biasing force against the indicator fuse element substantially along the line of the retaining force exerted by the indicator fuse element. The general application of leaf spring elements to provide the biasing force for fuse assembly indicator assemblies is also disclosed.

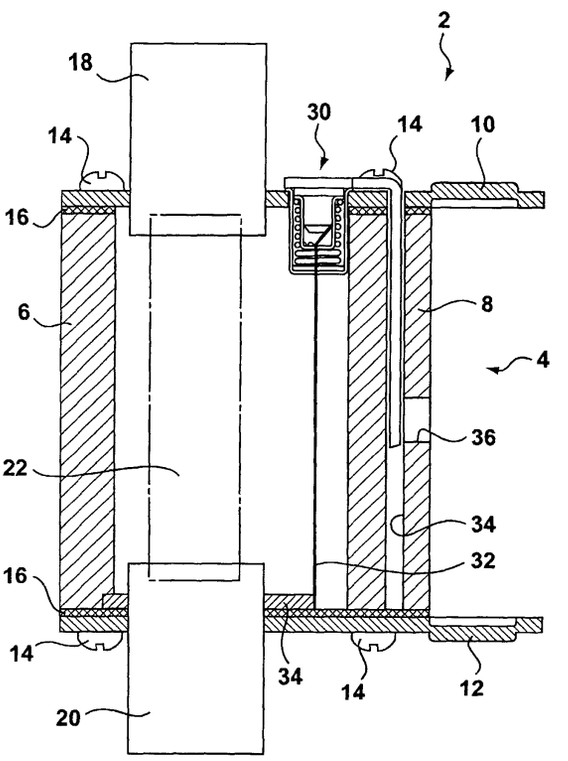

Figure 3

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Description

[0001] The present invention relates to a fuse assembly, particularly to a fuse assembly for use as a low-voltage high-breaking capacity fuse, commonly referred to in the art as a fuse link.

[0002] Low-voltage high-breaking fuse links are specified in International Standard IEC 60269-2-1, Section 1 and are commonly referred to in the art as "NH" fuses. Typically, fuse links of the aforementioned kind have a housing, generally rectangular in shape, across the interior of which extends a main fuse element. An indicator fuse element is arranged in parallel to the main fuse element and serves to control the position of an indicator assembly. The indicator assembly is arranged to provide to an observer an indication of the state of the main fuse element, in particular to provide a clear indication of the fuse in the blown state.

[0003] German patent application no. DE 1 034 751 discloses a fuse assembly of the aforementioned general configuration. An indicator assembly has an indicator element disposed at one end of the housing and has an indicator portion extending into a longitudinal channel formed in the housing wall. The indicator fuse element retains the indicator element in a first position against the biasing action of a helical spring. The helical spring is retained in an enlarged end portion of the channel in the housing wall and applies a force coaxial to the longitudinal axis of the indicator portion within the channel. Although available for some considerable time, the fuse assembly of DE 1 034 751, in particular the indicator assembly, does not appear to have been put into widespread use.

[0004] More recently, a considerable number and variety of designs of fuse assembly have been proposed, relying upon the use of a strip of sprung metal as the essential component of the indicator element. In particular, German Patent publication No. DE 32 03 211 A1 discloses a fuse assembly of the aforementioned general kind, having an indicator assembly comprising a single strip of sprung metal secured at one end to an end terminal of the fuse assembly, adjacent the end face of the fuse housing. The strip is formed so as to have a permanent curve and is arranged such that, in its rest state, the free end of the strip is displaced from the end face. The strip is held flat against the end face of the housing against its natural sprung bias by an indicator fuse element. Operation of the fuse assembly in the case of a current overload releases the strip, which assumes its natural curved rest position, thus indicating a melting of the fuse and a potentially problematic electrical circuit. A single strip indicator assembly is also disclosed in German Utility Model application No. G 90 06 337.6.

[0005] European Patent No. EP 0 044 997 discloses a fuse assembly of the aforementioned general kind having an indicator assembly activated by an indicator fuse element. The indicator assembly consists essentially of a metal strip folded to form two arms. The fold of the metal strip is formed such as to act as a spring, biasing the arms away from one another. One arm is secured to one end face of the housing, with the second arm being held in contact with the first by the indicator fuse element. Melting of the indicator fuse element releases the second arm of the indicator, which moves away from the end of the housing in an arcuate motion about the fold spring. Displacement of the second arm in this manner indicates to the observer an operated fuse assembly.

[0006] A similar arrangement to that of EP 0 044 997 is disclosed in German Patent publication No. DE 197 23 540 Al. The indicator assembly of EP 0 044 997 is supplemented in the device of DE 197 23 540 A1 by an indicator strip extending along a channel formed in one side of the fuse housing and extending from the end face of the housing. A window is present in the side face of the housing, opening into the channel, with the indicator strip extending across the window. Upon melting of the fuse elements of DE 197 23 540 A1, the second arm moves in an arc away from the end face of the housing, at the same time moving the indicator strip within the channel to a position distant from the window. In this way, the fuse assembly contains a double indication system for the condition of the fuse. Similar arrangements are disclosed in German Patent publication No. DE 197 44 535 A1, International Patent Application publication WO 98/07172, International Patent Application publication WO 00/11698 and German Utility Model DE 297 18 230 U1.

[0007] A further modification to the indicator assemblies of EP 0 044 997 and DE 197 23 540 A1 is described and shown in German Utility Model DE 298 07 928 U1. The indicator assembly of DE 298 07 928 U1 employs a folded metal strip, as described above. However, the first arm is secured to the end face of the housing of the fuse assembly at just its end. Upon operation of the fuse assembly, both the first and second arms of the indicator strip move in an arcuate path away from the end face of the housing. An indicator strip extending within a channel in the side of the housing provides a second indicator, as described above.

[0008] In yet a further modification to the aforementioned fuse assemblies, International Patent Application publication WO 99/40599 discloses a fuse assembly having an indicator assembly comprising a folded metal strip. The metal strip is folded upon itself twice, forming a Z-shaped indicator element, the base of which is secured to an end face of the housing. The folded metal strip is held flat against the end face of the housing by the indicator fuse element. Upon operation of the fuse, the indicator fuse element releases the folded metal strip, which moves in an arcuate motion and assumes its Z-shaped form. An indicator strip extending within a channel in the side wall of the fuse is attached to the free end of the folded metal strip and is employed to provide a second indication of the state of the fuse assem-

bly.

[0009] While the aforementioned designs of fuse assembly have found a measure of success in the market, it has been found that a problem can arise due to the indicator assembly failing to fully respond to operation of the fuse. In such a case, the observer is not given a clear indication that the fuse has operated or blown. This can result in the fuse being missed during an inspection. The potential of this occurring is markedly increased when an observer is required to inspect a bank containing a large number of identical fuse assemblies, in order to identify the operated item.

[0010] According to the present invention, there is provided, in a first aspect, a fuse assembly, comprising:

a main fuse element;
an indicator fuse element, arranged electrically in parallel with the main fuse element; and
an indicator assembly, the indicator assembly comprising an indicator movable between a first position and a second position, a biasing element biasing the indicator to the second position, the indicator being retained in the first position by the indicator fuse element against the action of the biasing element; whereby
melting of the indicator fuse element releases the indicator for movement from the first position to the second position, the biasing element acting to provide a biasing force against the indicator fuse element substantially along the line of the retaining force exerted by the indicator fuse element.

[0011] The arrangement of having the force biasing the indicator into the second position acting coaxially with the restraining force exerted by the indicator fuse element retaining the indicator element in the first position provides an improved operation of the indicator assembly. In particular, it prevents the movable elements of indicator assembly from travelling in an arcuate path, upon operation of the fuse. Such movement of the indicator assembly components can cause elements to become caught or trapped. For example, a portion of the indicator fuse element can become trapped as it is pulled out of the housing by the moving indicator to which it is attached. This can prevent a full and complete indication being given.

[0012] Further, movement of the indicator elements in an arcuate pattern results in one or more components of the indicator assembly moving laterally with respect to the end face of the housing. This lateral movement can also lead to portions of the indicator assembly becoming trapped or restricted in their movement. For example, in fuse assemblies in which a dual indication system is provided, lateral movement as aforementioned causes the indicator element extending within the channel in the side of the housing to be forced against the side of the channel. This can restrict the element from moving freely within the channel, in turn causing the indicator assembly to be held in an intermediate position between the first and second positions. The arrangement of the present invention prevents a lateral displacement of the elements of the indicator assembly parallel to the end face of the fuse housing.

[0013] The fuse assembly of the present invention provides an improved indicator assembly, in terms of its speed and reliability. It has been found that by eliminating the presence of a moment of forces generated within the indicator assembly between the point of connection of the indicator fuse element with the indicator assembly and the axis of action of the biasing force, the problems associated with the action of the indicator assembly discussed above can be prevented.

[0014] Preferably, the fuse assembly of the present invention comprises an indicator assembly providing an indication of the state of the fuse when viewed from two directions. More preferably, the indicator assembly provides an indication at both an end face of the housing and a side face of the housing.

[0015] In one preferred embodiment, the indicator assembly comprises a first indicator element, which, when in the first position, is flat against or substantially flush with an end face of the housing and, when in the second position, is displaced outwardly from the end face. In an alternative embodiment, the indicator assembly comprises an indicator element extending along one side of the housing. Preferably, the indicator element extends along a channel or groove formed in or on the surface of the side of the housing. If the channel is enclosed, a window is provided, through which the position of the indicator element may be seen to determine the state of the fuse assembly. A preferred embodiment of the fuse assembly of the present invention comprises an indicator assembly having both of the aforementioned indicator elements. The indicator elements may be any suitable form and colour necessary in order to provide a clear indication to an observer. A most convenient arrangement is one in which each indicator element is prepared from a strip of metal.

[0016] The biasing element and the indicator fuse element are preferably arranged whereby the biasing force exerted by the biasing element is acting along the longitudinal axis of the indicator fuse element.

[0017] The biasing element may be any suitable means capable of biasing the indicator element into the second position, for example a spring. Alternatively, a resilient material may be employed to provide the required biasing, or the inherent properties of the indicator element may be employed. If a resilient member is employed to provide the biasing means, this member may be held in tension or compression by the indicator fuse element. It is preferred that the resilient member is held in compression and provides its biasing force from a partially or wholly compressed state. The biasing force may also be provided by a portion of the indicator being held in an unnatural state, for example a naturally curved indicator being held flat or straight, or vice versa.

[0018] A first preferred embodiment of the fuse assembly of the present invention employs a helical spring arranged co-axially with the indicator fuse element, the coils of the spring extending around the indicator fuse element.

[0019] An alternative embodiment of the present invention employs a leaf spring arrangement to bias the indicator element into the second position. A preferred leaf spring arrangement is one comprising two leaves extending on opposing sides of the indicator fuse element and acting between the indicator element and the housing. A most suitable leaf spring arrangement is one in which the indicator element comprises a metal strip having opposing biasing leaves extending from one surface of the strip and bearing against a surface of the housing. The biasing leaves are disposed uniformly about the indicator fuse element.

[0020] It has been found that such an arrangement of opposing leaf springs maybe applied in a more general manner to provide the biasing necessary in fuse assemblies both according to the present invention and as a replacement for the biasing arrangements of the fuse assemblies of the prior art. Accordingly, in a further aspect, the present invention provides a a fuse assembly, comprising:

a main fuse element;
an indicator fuse element, arranged electrically in parallel with the main fuse element; and
an indicator assembly, the indicator assembly comprising an indicator element movable between a first position and a second position, a biasing element biasing the indicator element to the second position, the indicator being retained in the first position by the indicator fuse element against the action of the biasing element; wherein the biasing element comprises two leaf spring elements extending in opposing directions between the indicator element and a surface of the housing.

[0021] The leaf spring elements are preferably unitary with the indicator element, a most suitable arrangement being one in which the indicator element and the leaf spring elements are each formed from a single strip of sprung metal. Preferably, the leaf spring elements extend in opposite directions towards each other. As noted above, an essential feature of the fuse assembly of the first aspect of the present invention is that the biasing force exerted by the biasing element acts along substantially the same line as the retaining force exerted by the indicator fuse element, especially along the longitudinal axis of the indicator fuse element. Accordingly, the leaf spring elements are preferably arranged one on opposing sides of the indicator fuse element. By having the leaf spring elements of the same form and equidistant from the indicator fuse element, the required directly opposing and biasing forces is achieved.

[0022] It is an advantage of the fuse assembly of the present invention that operation of the fuse provides a positive and consistent operation of the indicator. In the fuse assembly of the present invention, the indicator may be employed simply to provide a visual indication of the state of the fuse elements within the housing. Alternatively, the biasing element may be used to urge the indicator into the second position and activate an electrical switch, for example a microswitch. The switch may in turn be used to provide an indication to an observer, for example by means of a lamp on a control panel remote from the fuse assembly, or to initiate another function, for example sound an alarm, shut down an item of equipment, and the like.

[0023] Embodiments of the present invention will now be described, by way of example only, having reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a first embodiment of the fuse assembly according to the present invention;
Figure 2 is a plan view of the first embodiment of the fuse assembly of Figure 1;
Figure 3 is a cross-sectional view of the first embodiment of the fuse assembly along the line III - III of Figure 2;
Figure 4 is an enlarged cross-sectional view of the indicator assembly of the fuse assembly of Figure 3;
Figure 5 is a cross-sectional view of a second embodiment of the fuse assembly according to the present invention;
Figure 6 is a plan view of a third embodiment of the fuse assembly according to the present invention;
Figure 7 is a cross-sectional view of the third embodiment of the fuse assembly along the line VI - VI of Figure 6; and
Figure 8 is a perspective view of the indicator element of the third embodiment of the fuse assembly.

[0024] Referring to Figure 1, a fuse assembly, generally indicated as 2, is shown, having a hollow, generally rectangular housing, generally indicated as 4. The housing 4 comprises a housing body 6 constructed from an electrically non-conductive material, typically a ceramic, and having a side wall 8. The hollow interior of the housing is filled with an inert filler, such as sand. The housing 4 further comprises two end plates 10, 12, secured at end of the housing body 6 by screws 14. An insulating gasket 16 extends between each end plate 10, 12 and the housing body 6.

[0025] Electrical terminals 18, 20 extend through each end plate 10, 12 respectively and outwards from each end of the housing 4. A main fuse element 22, visible in Figure 3, extends between the terminals 18, 20 and is secured to each terminal in a manner that provides an electrically conductive path through the fuse assembly. The shape and configuration of the main fuse element 22 is determined by the electrical current to be accommodated or the rating of the fuse assembly. The

appropriate form of the main fuse element 22 for a given duty is known in the art and readily determined by the person skilled in the art.

[0026] Referring to Figure 3, the fuse assembly 2 has an indicator assembly, generally indicated as 30. An indicator fuse element 32 is connected at one end to the terminal 20 by means of connection plate 34. The indicator fuse element 32 is arranged in parallel with the main fuse element 22. The indicator fuse element 32 is typically a fuse wire, of such a gauge that melting of the main fuse element 22, as a result of excessive electrical current, will cause the virtual immediate melting of the indicator fuse element 32. The state of the indicator fuse element 32 is used to control the indicator assembly 30, as will now be described in more detail, having reference to Figure 4.

[0027] As shown in Figure 4, a channel 34 is provided in the housing 4, in the form of a bore extending longitudinally through the side wall 8. A bore extending from the outer surface of the side wall 8 to the channel 34 provides a window 36, through which an observer may view a portion of the interior of the channel 34. The indicator assembly 30, comprises a cylindrical indicator housing 38 having one closed end 40 and secured so as to extends inwards through a hole in the end plate 10, with the closed end 40 innermost. The closed end 40 of the indicator housing 38 is provided with a hole 42 located at its center. A helical coil spring 44 is located in the indicator housing 38. The end coil of the spring 44 is an interference fit within the indicator housing 38. A retainer assembly 46 is held co-axially within the coils of the spring 44 and comprises a cylindrical retainer 48 having a closed end 50 arranged innermost within the spring 44 and a open end with a flange 52, against which the end coil of the spring 44 bears. A hole 54 is provided centrally in the closed end 50 of the retainer 48. A retainer plug 55 is an interference fit within the retainer 48. The second end portion of the indicator fuse wire extends through holes 42 and 54 in the ends 40 and 50 of the indicator housing 38 and the retainer 48 respectively. The second end of the indicator fuse element is held firmly between the retainer plug 56 and the inside of the retainer 48.

[0028] An L-shaped indicator 60 is provided having a first, short indicator element 62 and a second, long indicator element 64. The first indicator element 62 extends parallel to the surface of the end plate 10 across the open end of the indicator housing 38 and is secured to the retainer plug 56. The second indicator element 64 extends perpendicular to the first indicator element 62 within the channel 34 in the side wall 8 of the housing body 4. The second indicator element 64 is of a length sufficient to extend past the window 36.

[0029] In an alternative embodiment (not shown in the figures), the second indicator element extends along the outer surface of the side wall 8 of the housing. A groove may be provided in the outer surface to accommodate the second indicator element. If desired, a label with a hole may be affixed over the groove, to provide a window.

[0030] In use, the fuse assembly 2 is installed with the main and indicator fuse elements 22, 32 intact and electrically conductive. The spring 44 biases the indicator 60 into the second position (not shown), in which the first indicator element is displaced from the end plate 10 of the housing 4. The indicator fuse element 32 retains the indicator assembly 30 in the first position, as shown in Figures 1, 3 and 4. In particular, the indicator 60 is held with the spring 44 compressed and the first indicator element 62 against the end plate 10 by the indicator fuse element 32, acting against the biasing force of the spring 44. Melting of the main and indicator fuse elements 22, 32 releases the retainer assembly 46 and the indicator 60, which, under the action of the spring 44 move to the second position. Means (not shown) prevent the indicator 30 from being expelled completely from the fuse assembly under the action of the biasing force of the spring 44 upon melting of the indicator fuse element 32.

[0031] The state of the fuse assembly 2 is indicated to an observer in two manners. A first indication is provided by the position of the first indicator element 62 relative to the end plate 10 of the housing 4. A second indication is provided through the window 36 in the side wall 8 of the housing. In the embodiment shown in Figure 4, the second indicator element 64 is visible through the window when in the first position (as shown), but is not visible through the window when in the second position. In the alternative, the second indicator element 64 may be sufficiently long as to be visible through the window, when in both the first and second positions. In this case, an indication of the state of the fuse assembly is given, for example, by a change in colour or shape of the indicator visible through the window.

[0032] Referring to Figure 5, a second embodiment of the fuse assembly according to the first aspect of the present invention is shown. Elements common to the first and second embodiments are indicated using the same reference numerals. For a description of these features reference is made to the preceding disclosure relating to the first embodiment. The fuse assembly shown in Figure 5 is similar to that of Figures 1 to 4, in that it relies upon a helical spring 144 to bias the indicator 160 into the second position, as shown in Figure 5. In the embodiment of Figure 5, the indicator fuse element 32 is retained at its first end by a plug 100 held in a hole in the end plat 12 of the housing 4 by an interference fit. The indicator 160 comprises first and second indicator elements 162, 164. The helical spring 144 is not retained in a recess within the housing 4, as is the case with the first embodiment. Rather, as shown in Figure 5, the helical spring 144 bears on the surface of the end plate 10 and the first indicator element 162. The second end portion of the indicator fuse element 32 extends through a second plug 102 in the end plate 10, through the center of the helical spring 144 and is se-

cured to the first indicator element 162. The second indicator element 164 is provided with a step 166 in its surface. A taper 168 allows the second indicator element 164 to be inserted into the channel 34 in the side wall 8 of the housing 4. Once inserted, the step 166 abuts the gasket 16 and prevents complete removal of the second indicator element 164.

[0033] The fuse assembly of Figure 5 is shown with the indicator assembly 130 in the second position, that is indicating an operated or blown fuse. Operation of the fuse assembly of this embodiment is substantially as hereinbefore described with respect to the first embodiment.

[0034] Referring to Figures 6, 7 and 8, a third embodiment of the fuse assembly of the present invention is shown. Elements common to the first and third embodiments are indicated using the same reference numerals. For a description of these features, reference is made to the preceding disclosure relating to the first embodiment. The embodiment shown in Figures 6 and 7 comprises an alternative indicator assembly 230. The indicator assembly comprises an indicator 232 having a first indicator element 234 and a second indicator element 236. The indicator is shown in detail in Figure 8 and comprises the first and second indicator elements 234, 236 arranged to form an L-shape. The first indicator element 234 has first and second leaf spring elements 240 and 242 unitary with it and extending from one face. Each leaf spring element 240, 242 is in the form of an arcuate leaf having a free end curved to form a foot. The leaf spring elements 240, 242 extend from the same face of the first indicator element 234, but in opposite directions towards each other. As shown in Figure 7, the two leaf spring elements 240, 242 are disposed equidistant on either side of the indicator fuse element 32. The leaf spring elements have substantially the same length and radius of curvature. Being formed from a single member, this provides the leaf spring elements 240, 242 with the same biasing properties. The leaf spring elements 240, 242 together bias the indicator 230 into the second position, as shown in Figure 7. The second end of the indicator fuse element 32 is secured to the first indicator element 234 at a point between the two leaf spring elements 240, 242, as shown in Figure 7.

[0035] In operation, the fuse assembly 2 is installed with the indicator assembly 230 retained in the first position (not shown) by the indicator fuse element 32. In the first position, the indicator 232 is held with the first indicator portion retained close to or in contact with the end plate 10 of the housing 4. In this position, the leaf springs 240, 242 are compressed, with their feet forced outwards from the indicator fuse element 32. Upon melting of the main and indicator fuse elements 22 and 32, the indicator assembly 230 is freed to move, under the action of the leaf spring elements 240, 242, to move to the second position. The indications regarding the state of the fuse assembly given to an observer are as described above with respect to the first embodiment.

[0036] As noted above, the fuse assembly shown in Figures 6 to 8 employs the indicator 232 in accordance with the first aspect of the present invention. However, as also noted, the use of leaf spring elements to bias the indicator into the second position has a more general application, such as a replacement for the biasing means of the prior art fuse assemblies discussed above.

Claims

1. A fuse assembly, comprising:

a main fuse element;
an indicator fuse element, arranged electrically in parallel with the main fuse element; and
an indicator assembly, the indicator assembly comprising an indicator movable between a first position and a second position, a biasing means biasing the indicator to the second position, the indicator being retained in the first position by the indicator fuse element against the action of the biasing means; whereby
melting of the indicator fuse element releases the indicator for movement from the first position to the second position, the biasing element acting to provide a biasing force against the indicator fuse element substantially along the line of the retaining force exerted by the indicator fuse element.

2. A fuse assembly according to claim 1, wherein the biasing element acts to provide a biasing force substantially co-axially with the longitudinal axis of the indicator fuse element.

3. A fuse assembly according to either of claims 1 or 2, wherein the biasing element comprises a resilient member.

4. A fuse assembly according to claim 3, wherein the resilient member is a spring.

5. A fuse assembly according to claim 4, wherein the spring is a helical spring.

6. A fuse assembly according to claim 5, wherein the helical spring is housed in a recess extending inwards from one end of the housing.

7. A fuse assembly according to either of claims 5 or 6, wherein a single helical spring is provided, the coils of which extend around the longitudinal axis of the indicator fuse element.

8. A fuse assembly according to claim 4, wherein the spring comprises one or more leaf spring elements.

9. A fuse assembly according to claim 8, wherein the spring comprises two leaf spring elements, each element being secured at one end to the indicator and extending between the indicator and the housing.

10. A fuse assembly according to claim 9, wherein the two spring elements extend in opposite directions.

11. A fuse assembly according to claim 10, wherein the two spring elements extend towards each other.

12. A fuse assembly according to any of claims 9 to 11, wherein the two leaf spring elements are spaced equidistant from and on opposing sides of the longitudinal axis of the indicator fuse element.

13. A fuse assembly according to any of claims 8 to 12, wherein each leaf spring element is unitary with the indicator.

14. A fuse assembly according to any preceding claim, wherein the indicator comprises two indicator elements, each indicator element giving a separate indication of the state of the fuse assembly.

15. A fuse assembly according to claim 14, wherein the indicator elements extend perpendicular to each other.

16. A fuse assembly according to claim 15, wherein one indicator element provides an indication on one end of the housing and the second indicator provides an indication on a side of the housing.

17. A fuse assembly according to any preceding claim, wherein the indicator is provided with a retainer, to prevent complete ejection or removal of the indicator from the fuse assembly.

18. A fuse assembly according to claim 17, wherein the retainer comprises a step profile on a surface of the indicator, the step profile engaging with an element of the housing to limit the movement of the indicator to movement between the first and the second position.

19. A fuse assembly according to any preceding claim, wherein, when in the second position, at least a portion of the indicator is displaced from the surface of the housing.

20. A fuse assembly, comprising:

a main fuse element;
an indicator fuse element, arranged electrically in parallel with the main fuse element; and
an indicator assembly, the indicator assembly comprising an indicator element movable between a first position and a second position, a biasing element biasing the indicator element to the second position, the indicator being retained in the first position by the indicator fuse element against the action of the biasing element; wherein the biasing element comprises two leaf spring elements extending in opposing directions between the indicator element and a surface of the housing.

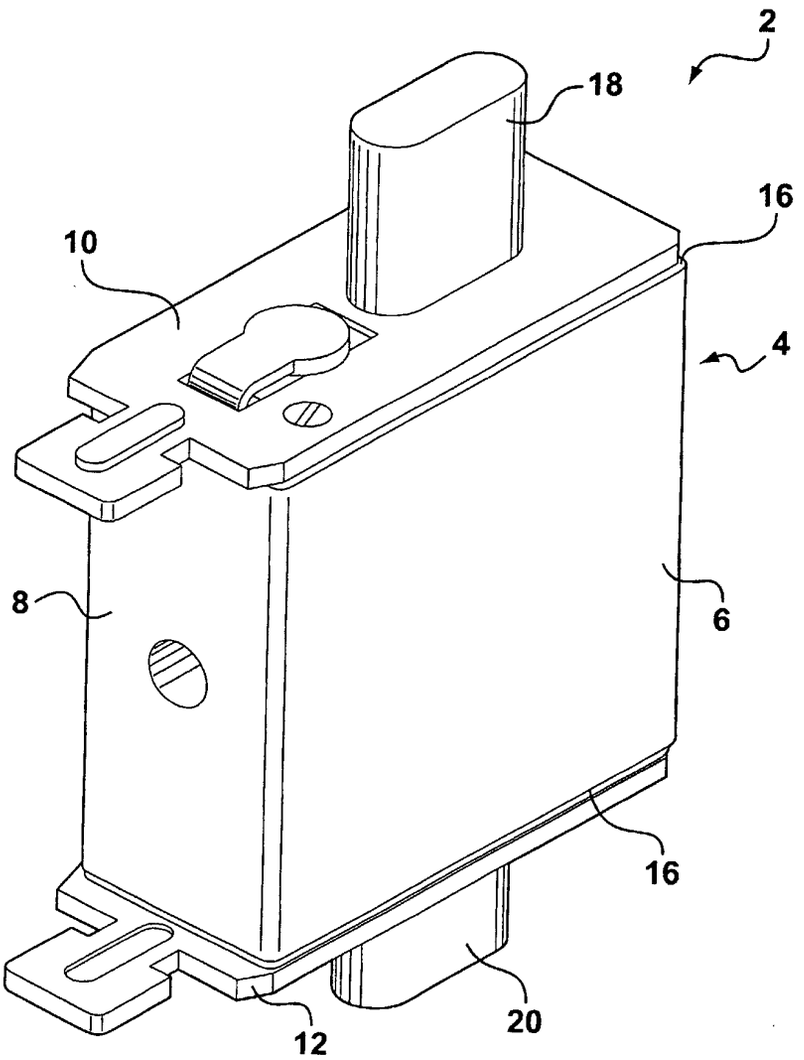

Figure 1

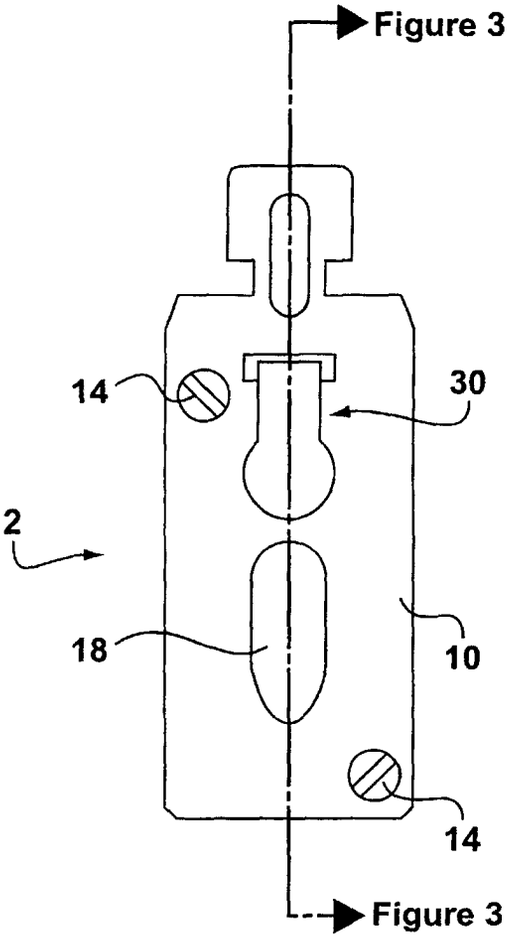

Figure 2

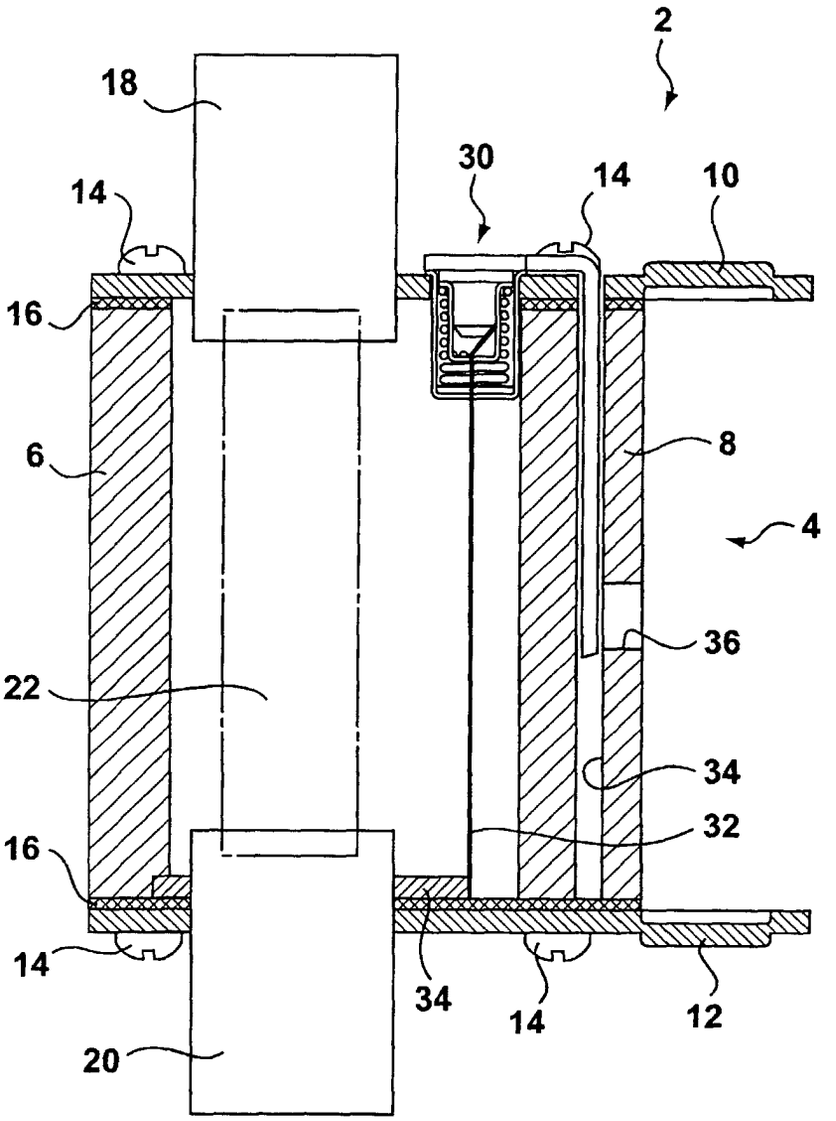

Figure 3

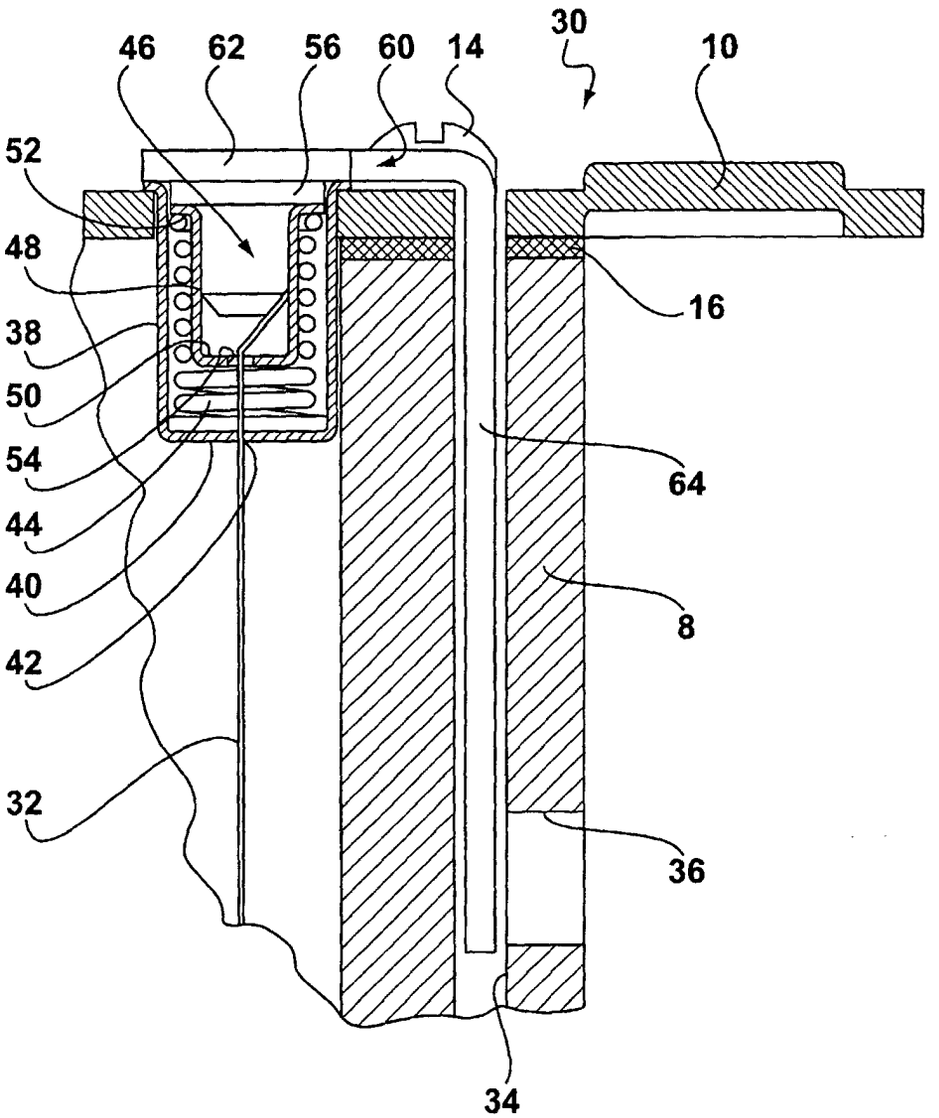

Figure 4

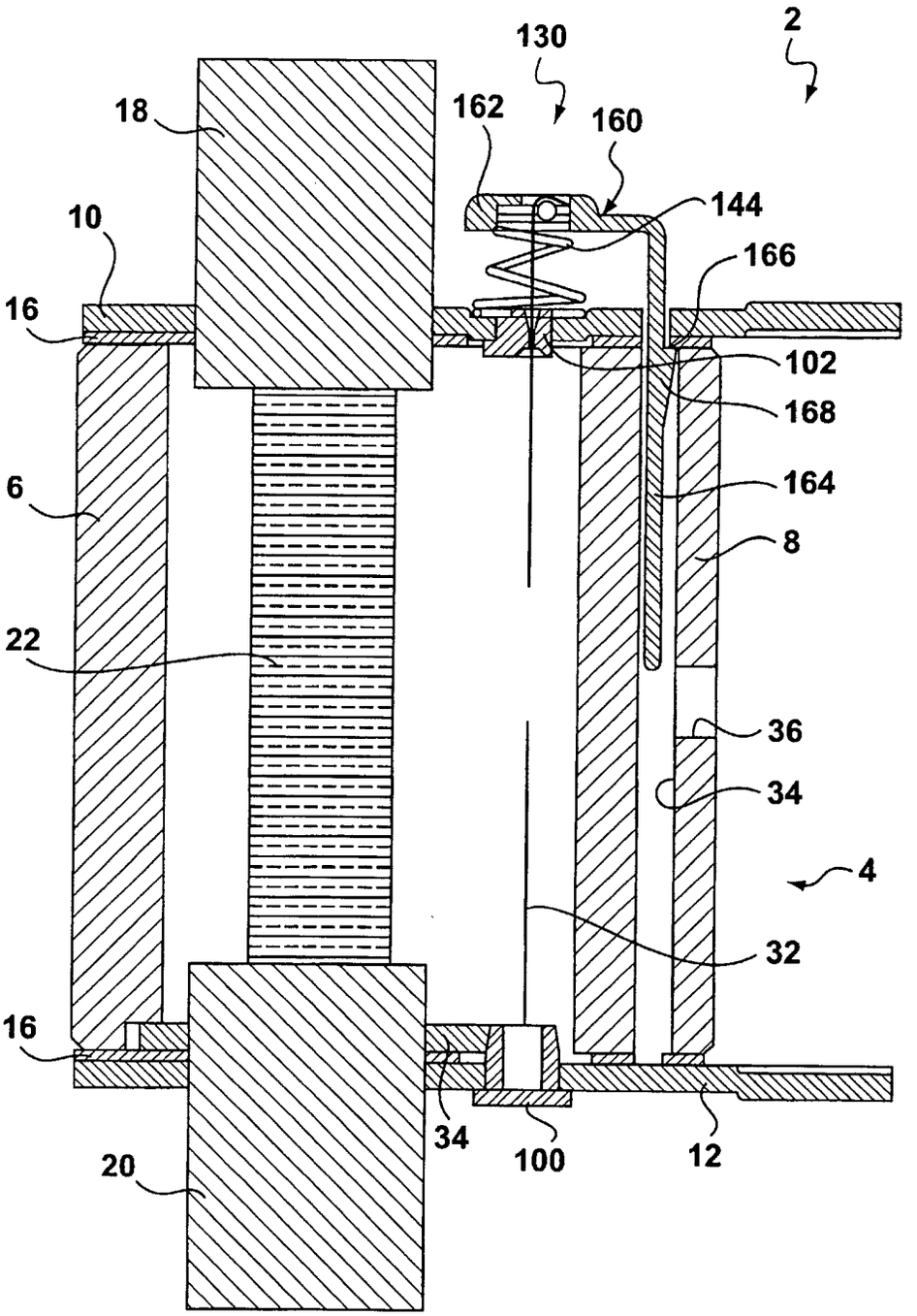
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Figure 5

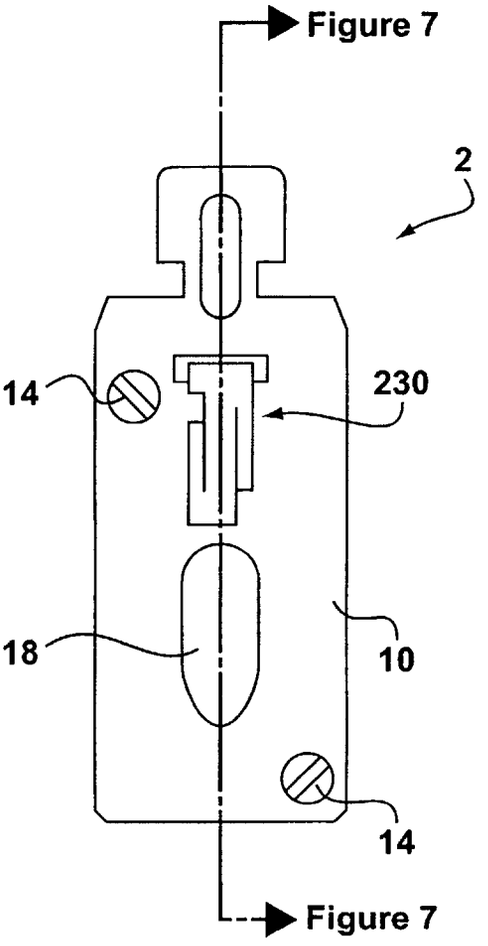

Figure 6

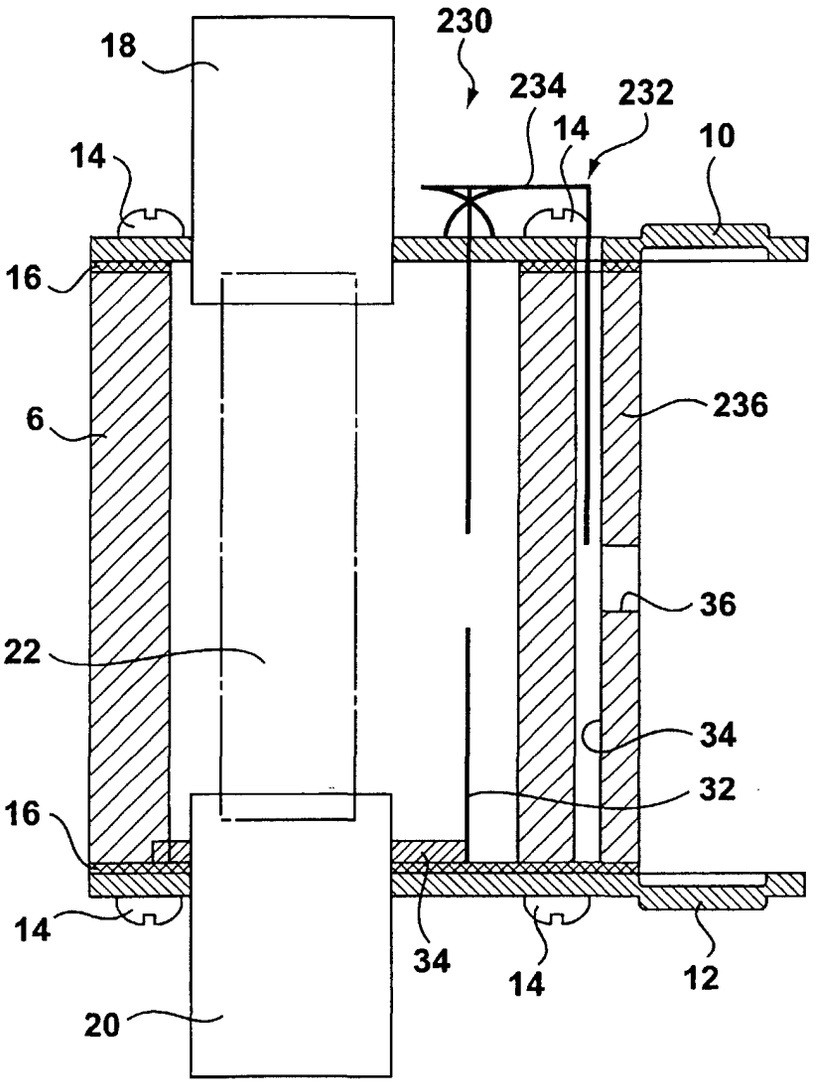

Figure 7

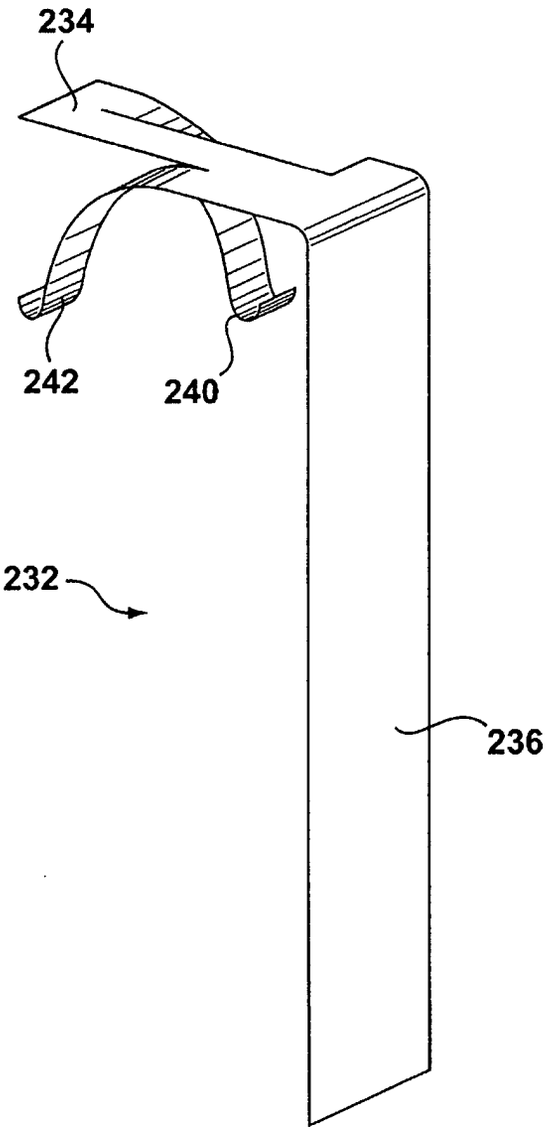

Figure 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 25 1452

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 4 023 133 A (KNAPP JR EDWARD J) 10 May 1977 (1977-05-10) * page 3, column 2, line 9 - page 4, column 3, line 14; figure 2 *	1-7, 14-16,19	H01H85/30
X	EP 0 049 374 A (SIEMENS AG) 14 April 1982 (1982-04-14) * page 5, line 16 - page 9, line 7; figures 1,11 *	1-4,8-11	
X	FR 1 465 397 A (COMPAGNIE GÉNÉRALE D'ÉLECTRICITÉ) 13 January 1967 (1967-01-13) * page 1, column 2, last paragraph - page 2, column 2, paragraph 3; figures 1-4 *	1-9,13, 17-19	
X	DE 25 57 289 A (ANDERSSON PER ULF) 1 July 1976 (1976-07-01) * page 4, last paragraph - page 6, last paragraph; figures 1-5 *	1-4, 8-12,20	
A	US 5 418 515 A (REYES DANIEL) 23 May 1995 (1995-05-23) * page 12, column 8, line 14 - line 56; figure 7 *	8-13,20	TECHNICAL FIELDS SEARCHED (Int.Cl.7) H01H
A	EP 0 420 351 A (INVER SRL) 3 April 1991 (1991-04-03) * page 3, column 4, line 9 - line 25; figure 4 *	8-13,20	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	5 May 2003	Pirvulescu, M

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05-05-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4023133 A	10-05-1977	NONE	
EP 0049374 A	14-04-1982	DE 3034762 A1	25-03-1982
		AR 226919 A1	31-08-1982
		BR 8105859 A	08-06-1982
		DK 407481 A	16-03-1982
		EP 0049374 A2	14-04-1982
		ES 8206913 A1	16-11-1982
FR 1465397 A	22-03-1967	NONE	
DE 2557289 A	01-07-1976	SE 396256 B	12-09-1977
		DE 2557289 A1	01-07-1976
		SE 7416205 A	21-06-1976
US 5418515 A	23-05-1995	AU 1276095 A	10-07-1995
		EP 0685111 A1	06-12-1995
		WO 9517761 A1	29-06-1995
		JP 8055559 A	27-02-1996
EP 0420351 A	03-04-1991	IT 1231070 B	12-11-1991
		EP 0420351 A2	03-04-1991

EPO FORM P0459

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