Trial decision

Invalidation No. 2013-800007

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The decision on the case of the patent invalidation trial between the above parties on Japanese Patent No. 3552539, entitled "THERMAL FUSE WITH RESISTANCE," dated March 27, 2014 came with a court decision of revocation of the trial decision (2014 (Gyo-Ke) 10107, rendition of decision on December 24, 2014) at the Intellectual Property High Court, the case was proceeded further, and another trial decision was handed down as follows.

Conclusion

The correction shall be approved as requested.

The patent for the inventions according to Claims 1 and 2 of Patent No. 3552539 shall be invalidated.

The part of the trial decision dated March 27, 2014, "The costs in connection with the trial shall be borne by the demandant," is cancelled.

One half of the costs in connection with the trial decision shall be borne by the demandant, and one half shall be borne by the demandee.

Reason

No. 1 History of the procedures

The application regarding the patent of case No. 3552539 (hereinafter referred to as "the Patent") was filed on June 19, 1998, and the establishment of patent right was registered on May 14, 2004.

The history of the procedures in connection with the demand for invalidation trial of the case is as follows.

January 17, 2013	Demand for invalidation trial of the case
April 5, 2013	Submission of written reply
April 25, 2013	Notification of matters to be examined
June 6, 2013	Submission of oral proceedings statement briefs from both parties
June 20, 2013	Submission of oral proceedings statement brief (2) from the demandee
June 20, 2013	Submission of oral proceedings statement brief (2) from the demandant
June 20, 2013	Oral proceedings
July 4, 2013	Submission of written amendment and written statement from the demandant
July 17, 2013	Submission of written statement from the demandee
August 28, 2013	Advance notice of trial decision
October 25, 2013	Submission of written correction request from the demandee
October 28, 2013	Submission of written statement from the demandant
December 12, 2013	Submission of written refutation from the demandant
January 8, 2014	Decision of acceptance or non-acceptance of amendment
February 7, 2014	Submission of written reply (2) from the demandee
March 27, 2014	Trial decision (the first trial decision)
December 24, 2014	Rendition of court decision (2014 (Gyo-Ke) 10107)
February 12, 2015	Advance notice of trial decision

The demandant withdrew the oral proceedings statement brief (2) submitted on June 20 in the oral proceedings.

The body gave advance notice of the trial decision to the demandee dated February 12, 2015, and gave an opportunity for filing a request for correction within a designated period. The demandee has filed no response to the advance notice of the trial decision.

No. 2 Scope of proceedings of the trial decision

The court decision (2014 (Gyo-Ke) 10107) rendered on December 24, 2014 held,

"1 The part of the trial decision, which was made by the Japan Patent Office for Invalidation No. 2013-800007 on March 27, 2014 corresponding to Claims 1 and 2 of Patent No. 3552539, is cancelled.

2 The other demands of the plaintiff shall be dismissed.

3 One half of the costs in connection with the trial decision shall be borne by the plaintiff, and the remainder shall be borne by the defendant,"

and the decision has become final and binding.

Therefore, the first trial decision has become final and binding on the portion "groundless" for the demand of the demandant to invalidate the inventions according to Claims 3 and 4 of Patent No. 3552539, and has become integrally final and binding on the portion, "The correction shall be approved," for the Corrections C and D in the written correction request dated on October 25, 2013 relating to Claims 3 and 4.

Thus, an object to be proceeded in the trial decision of the case is only a portion relating to Claims 1 and 2 for which the conclusion, "The demand for trial of the case was groundless," in the first trial decision was revoked in the above judgment.

No. 3 Request for correction

1. Object of the request and details of the correction

The correction (hereinafter referred to as "the Correction") demanded by the demandee with the written correction request dated October 25, 2013 is to correct the specification attached to the application of the patent for each claim or each group of claims as the corrected specification attached to the written correction request, and the details of the request are as follows.

(1) Correction A

The limitation matter,

"flux is arranged around the low-melting point alloy body and a case is brought into airtight contact with the ceramic substrate, to protect the flux from an outdoor air environment," is added to Claim 1 of the scope of claims before correction.

(2) Correction B

The description of Claim 2 of the scope of claims before correction,

"a thermal fuse with resistance described in Claim 1 configured so that an intermediate part of the low-melting point alloy body is supported by a high heat conductor arranged on the ceramic substrate,"

is corrected to the description,

"a thermal fuse with resistance formed by arranging a low-melting point alloy body on one side of a ceramic substrate and a heating element on the other side, and configured to melt and cut the low-melting point alloy body with heat via the ceramic substrate by applying electric power to the heating element, to shut off a circuit, the low-melting point alloy body being flat and arranged in a position opposite the heating element on one side of the ceramic substrate, having both ends and an intermediate part connected to electrodes, the heating element being powered via the electrode of the intermediate part, and the intermediate part of the low-melting point alloy body being supported by a high heat conductor arranged on the ceramic substrate."

2. Judgment on Propriety of Correction

(1) Regarding Correction A

Correction A is to add the flux and the case to the invention according to Claim 1 before correction, and aims at "restriction of the scope of claims" stipulated in Article 134-2(1)(i) of the Patent Act.

The following description is included in [0016] of the patent specification, "... when in use, the case 14 is brought into airtight contact with the ceramic substrate 11, to protect the low-melting point alloy body 12 or the flux arranged around the low-melting point alloy body, which is not shown, from an outdoor air environment."　Correction A is a correction that is within the matters described in the patent specification.

Correction A is to restrict the scope of claims, and does not substantially enlarge or modify the scope of claims of the patent.

(2) Regarding Correction B

Correction B dissolves the citation relation between the claims, to change the description of Claim 2 before correction dependent on Claim 1 to an independent claim to be Claim 2 after correction.

Thus, Corrections B is "to change the description of claims dependent on other claims into claims which are not dependent on other claims" as prescribed in Article 134-2(1)(iv) of the Patent Act, and is within the matters described in the patent specification. The Correction does not substantially enlarge or modify the scope of claims of the patent.

3. Summary

As described above, the Correction of the case aims at matters prescribed in Article 134-2(1)(i) and (iv) of the Patent Act and falls under the provisions of Article 126(5) and (6) of the Patent Act, which is applied mutatis mutandis in the provisions of Article 134-2(9).

As described in No. 2, as for the Corrections C and D relating to Claims 3 and 4, the decision has become final and binding as described in the first trial decision.

Therefore, the corrections shall be approved.

No. 4 The Invention

As described above, the Correction was approved, and the inventions (hereinafter referred to as "Inventions 1 and 2") according to Claims 1 and 2 of the Patent are as follows, as described in Claims 1 and 2 of the scope of claims of the corrected specification attached to the written correction request.

"[Claim 1]

A thermal fuse with resistance formed by arranging a low-melting point alloy body on one side of a ceramic substrate and a heating element on the other side, and configured to melt and cut the low-melting point alloy body with heat via the ceramic substrate by applying electric power to the heating element, to shut off a circuit, the low-melting point alloy body being flat and arranged in a position opposite the heating element on one side of the ceramic substrate, having both ends and an intermediate part connected to electrodes, the heating element being powered via the electrode of the intermediate part, wherein flux is arranged around the low-melting point alloy body and a case is brought into airtight contact with the ceramic substrate, to protect the flux from an outdoor air environment.

[Claim 2]

A thermal fuse with resistance formed by arranging a low-melting point alloy body on one side of a ceramic substrate and a heating element on the other side, and configured to melt and cut the low-melting point alloy body with heat via the ceramic substrate by applying electric power to the heating element, to shut off a circuit, the low-melting point alloy body being flat and arranged in a position opposite the heating element on one side of the ceramic substrate, having both ends and an intermediate part connected to electrodes, the heating element being powered via the electrode of the intermediate part, the intermediate part of the low-melting point alloy body being supported by a high heat conductor arranged on the ceramic substrate."

No. 5 Demandant's allegation

In the written demand for trial, the demandant demanded the decision to invalidate the patent for the inventions according to Claims 1 to 3 before correction.

The demandant submitted a written refutation as of December 12, 2013, and demanded the decision to invalidate the patent for the inventions according to Claims 1 to 4 after correction.

The demandant alleges, in the written refutation, the reason for invalidation with respect to the invention according to Claim 1 after correction, by adding new means of proof to the matters added by correction, and alleges the reason for invalidation with respect to the invention according to Claim 4 after correction by adding new means of proof for the invention according to Claim 2 before correction to the means of proof for the invention according to Claim 3 before correction due to changing the description from dependent claims to independent claims. The addition of means of proof and modification of reasons correspond to amendment to modify the gist of written demand for trial. Since the amendment falls under the provision of Article 131-2(2)(i) of the Patent Act, "necessity to amend the statement of a demand due to a demand for correction," and is "obviously unlikely to delay a trial decision unduly," it was accepted at the decision of acceptance or non-acceptance of amendment dated January 8, 2014.

The reasons and means of proof are as follows.

As described in No. 2, the decision has become final and binding on the portion, "groundless," for the demand of the demandant to invalidate the inventions according to Claims 3 and 4.

1. Reasons for invalidation

The inventions according to Claims 1 to 4 of the Patent could have been easily invented by a person skilled in the art on the basis of the invention described in publications distributed in Japan before the application was filed, and the demandee should not be granted a patent under the provisions of Article 29(2) of the Patent Act. Thus, the Patent should be invalidated under the provisions of Article 123(1)(ii) of the Patent Act.

The outline of the allegation is as follows.

(1) Regarding the invention according to Claim 1

The invention according to Claim 1 is only an invention that could have been easily invented by a person skilled in the art on the basis of Evidences A No. 2, No. 3, and Nos. 15 to 18.

(2) Regarding the invention according to Claim 2

The invention according to Claim 2 is only an invention that could have been easily invented by a person skilled in the art on the basis of Evidences A No. 2, No. 3, and No. 5.

2. Means of proof

The demandant submitted Evidences A Nos. 1 to 8 attached to the written demand for trial, Evidences A No. 9 and No. 10 attached to the oral proceedings statement brief, Evidences A Nos. 11 to 14 attached to the written statement dated July

4, 2013, and Evidences A Nos. 15 to 18 attached to the written refutation.

Evidence A No. 1: Japanese Patent No. 3552539 (Patent publication of the case)
Evidence A No. 2: Japanese Utility Model Publication No. H4-36027
Evidence A No. 3: Japanese Unexamined Patent Application Publication No. H7-153367
Evidence A No. 4: Japanese Utility Model Publication No. H6-38351
Evidence A No. 5: Japanese Utility Model Publication No. H4-36021
Evidence A No. 6: Japanese Unexamined Patent Application Publication No. S60-37632
Evidence A No. 7: microfilm of Japanese Utility Model Application No. S51-151505 (Japanese Unexamined Utility Model Application Publication No. S53-67425)
Evidence A No. 8: CD-ROM of Japanese Utility Model Application No. H4-37269 (Japanese Unexamined Utility Model Application Publication No. H5-90776)
Evidence A No. 9: "Electronic technology" Vol. 38 No.11 published by Nihon Kogyo Shinbunsha on November 1, 1996
Evidence A No. 10: Japanese Unexamined Patent Application Publication No. H4-269487
Evidence A No. 11: Electronic Industries Association of Japan standardization promotion, standard of forming size of fixed resistor for consumer electronic appliances, established in July, 1980
Evidence A No. 12: Electronic Industries Association of Japan list of specifications
Evidence A No. 13: Outline of Electronic Industries Association of Japan
Evidence A No. 14: Surface mounting technology Vol. 6 No.8 published by NIKKAN KOGYO SHIMBUN, LTD. on August 1, 1996
Evidence A No. 15: Japanese Unexamined Patent Application Publication No. H8-161990
Evidence A No. 16: Japanese Unexamined Patent Application Publication No. H9-17302
Evidence A No. 17: Japanese Unexamined Patent Application Publication No. H9-231897
Evidence A No. 18: Japanese Unexamined Patent Application Publication No. H7-230747

Although, in the written demand for trial, "Japanese Unexamined Utility Model Application Publication No. S53-67425" is indicated as Evidence A No. 7, a copy of the "microfilm of Japanese Utility Model Application No. S51-151505 (Japanese Unexamined Utility Model Application Publication No. S53-67425)" is attached actually. Similarly, "Japanese Unexamined Utility Model Application Publication No. H5-90776" indicated as Evidence A No. 8 is a copy of "CD-ROM of Japanese Utility Model Application No. H4-37269 (Japanese Unexamined Utility Model Application Publication No. H5-90776)."

No. 6 Demandee's allegation

The demandee demands the trial decision, "The demand for trial of the case was groundless. The costs in connection with the trial shall be borne by the demandant," and alleges as follows.

Regarding the reasons for invalidation

The invention according to Claim 1 of the Patent is not an invention which could have been easily invented by a person skilled in the art on the basis of the inventions described in Evidences A No. 2, No. 3, and Nos. 15 to No. 18. The invention according to Claim 2 of the Patent is not an invention that could have been easily invented by a person skilled in the art on the basis of the inventions described in Evidences A No. 2, No. 3, and No. 5.

No. 7 Judgment by the body

As described in No. 2, the portions relating to Claims 1 and 2 are examined below.

1. Matters described in Evidences A

(1) Evidence A No. 2

The following matters are described by reference to drawings in Evidence A No. 2 (Japanese Utility Model Publication No. H4-36027).

(A) "[Claim of Utility Model]

A thermal fuse with resistance formed from,
a plurality of film low-melting point metal bodies arranged on one side of an insulating substrate, connected in series by a film conductor,
and a plurality of film resistors arranged on the other side of the insulating substrate, in correspondence with each of the said film low-melting point metal bodies." (p. 1 the first column l. 1-l. 6)

(B) "< Industrial Application Field>
The device relates to improvement of a substrate-type thermal fuse with resistance."
(p. 1 the first column l. 8-l. 10)

(C) "<Prior art and problems>

A substrate-type thermal fuse with resistance, which is formed by arranging a film resistor on one side of an insulating substrate and a film low-melting point metal body on the other side of the insulating substrate, is well known.

The point of using the thermal fuse with resistance is to transmit the heat generated in the film resistor due to overcurrent to the film low-melting point metal body, to melt and cut the low-melting point metal body, and to shut off the overcurrent by cutting. However, due to poor heat transfer characteristics of a heat path where the heat generated in the film resistor is transferred to the film low-melting point metal body via the thickness of the insulating substrate, operating characteristics are poor."
(p. 1 the first column l. 11-l. 22)

(D) "<Object of the device>

The object of the device is to improve heat transfer characteristics, thereby improving operation characteristics, in the substrate-type thermal fuse with resistance."
(p. 1 the first column l. 23-l. 26)

(E) "<Configuration of the device >

The thermal fuse with resistance according to the device is formed from a plurality of film low-melting point metal bodies arranged on one side of an insulating substrate, connected in serieas by a film conductor, and a plurality of film resistors arranged on the other side of the insulating substrate, in correspondence with each of the said film low-melting point metal bodies." (p. 2 the second column l. 1-l. 7)

(F) "<Description of examples>

The device is described by reference to drawings below.

FIG. 1 is a top-view diagram illustrating the thermal fuse with resistance according to the device. FIG. 2 is a back diagram illustrating the fuse.

In the figures, reference numeral 1 denotes an insulating substrate, such as a ceramic board. Reference numerals 21, 21 and 22, 22 denote counter film electrodes arranged on one side of the substrate, symmetrically with respect to the center line n-n of the insulating substrate 1. Reference numerals 31 and 32 denote film resistors arranged between the electrodes 21, 21, 22, 22, and are of the same size and thickness. Reference numerals 4, ... denote lead conductors for the counter electrodes. Reference numeral 5 denotes an insulating coat. Reference numerals 61, 62 denote film low-melting point metal bodies arranged on the other side of the substrate 1, in the same positions as the film resistors 31, 32. Therefore, the film low-melting point metal bodies 61, 62 are located symmetrically with respect to the center line n-n.

Reference numerals 71, 72 denote fluxes. Reference numeral 8 denotes a film conductor for connecting the film low-melting point metal bodies 61, 62 in series. Reference numerals 91, 92 denote film auxiliary conductors for the film low-melting point metal bodies 61, 62, and are located on the center line n-n of terminal lands 910, 920. Reference numerals 10, 10 denote lead conductors connected to the lands. Reference numeral 11 denotes an insulating coat.

When the fuse is actuated, the film low-melting point metal bodies are melted and cut with heat generated in the film resistors due to overcurrent. The film low-melting point metal bodies are heated by two film resistors, or two heat sources, and heat transfer efficiency is high. Thus, quick operability of the fuse can be guaranteed.

The film low-melting point metal bodies are arranged for the film resistors, respectively, heat sources and heat receiving elements are arranged symmetrically with respect to the fuse, and the heat based on the heat sources is distributed symmetrically. Heat distribution is uniformly, thereby generating uniform distortion of the fuse due to heat cycle. Accordingly, early damage of the thermal fuse with resistance during multiple heat cycles before fusing can be protected, and the fuse can be used without problem even under severe heat cycles." (p. 1 the second column l. 8-p. 2 the fourth column l. 1)

(G) "<Effect of the device>

Accordingly, in the substrate-type thermal fuse with resistance according to the device having film resistors and film low-melting point metal bodies arranged on both sides of an insulating substrate across the thickness thereof, sufficient quick operability can be secured, distortion can be uniformly distributed during heat cycles, and stability can be guaranteed under severe heat cycles.

In this device, three film low-melting point metal bodies and three film resistors for the metal bodies may be arranged." (p. 2 the fourth column l.2- l. 12)

(H) From FIG. 2, it can be recognized that respective ends of the film low-melting point metal bodies (61, 62) are connected to the ends of the film conductor (8) and the film auxiliary conductors (91, 92), and the fluxes (71, 72) are arranged around the film low-melting point metal bodies (61, 62).

According to the description of the above matters and drawings, it can be recognized that the following invention (hereinafter referred to as "Cited invention") is described in Evidence A No. 2.

[Cited invention]
"A thermal fuse with resistance formed by arranging film low-melting point metal bodies (61, 62) on the other side of an insulating substrate (1) formed of a ceramic board, and film resistors (31, 32) on one side, and is configured to apply electricity to the film resistors (31, 32) to melt and cut the film low-melting point metal bodies (61, 62) with heat via the insulating substrate (1), for shutting off a circuit, the film low-melting point metal bodies (61, 62) being formed in a film shape and arranged in the same positions on the other side of the insulating substrate (1) as the film resistors (31, 32), the metal bodies having respective ends being connected to a film conductor (8) and film auxiliary conductors (91, 92), and fluxes (71, 72) arranged around the film low-melting point metal bodies (61, 62)."

(2) Evidence A No. 3
The following matters are described by reference to drawings in Evidence A No. 3 (Japanese Unexamined Patent Application Publication No. H7-153367).
(A) "[0001]
[Industrial Application Field] This invention relates to a protection element having a suitable fuse resistor applied to a chargeable and dischargeable secondary battery, for example, a manufacturing method thereof, and a circuit substrate having the element.
[0002]
[Conventional Art and Problem to be Solved by the Invention] Conventional fuse resistors are classified roughly into two types, current fuses which operate with overcurrent and thermal fuses which operate with temperature. However, the above two operation sources do not satisfy fuse functions as industries are developed recently.
[0003] A protection circuit may be included in a chargeable and rechargeable secondary battery in order to prevent the battery from being overcharged. Since an extremely overcharged battery generates a gas internally and may cause explosion, battery function may be disabled by a fuse, or the like.
[0004] In this case, a fuse resistor which detects a voltage is required, and a conventional fuse resistor cannot satisfy the requirement.
[0005] For example, in Japanese Unexamined Patent Application Publication No. H4-32879, a fuse resistor configured to melt and cut a low-melting point metal with a PTC as a heat source is specified where the low-melting point metal and the PTC are electrically connected in series. The heat source does not operate when a large current, such as strobe flash, flows instantaneously, and melts and cuts a fuse with heat generated in the PTC when a current equal to or larger than a prescribed current flows due to overdischarge. Thus, it cannot be used for the above purpose.
[0006] This invention is made in view of the problem, and aims to provide a protection element which operates by detecting a voltage, a manufacturing method thereof, and a circuit substrate including the protection element."
(B) "[0017]
[Operation] The protection element of the invention is formed of a low-melting point metal 6, a heat generator 5, and a detection element 9, and is configured so that the low-melting point metal 6 and the heat generator 5 are brought into contact with each other

via an insulation layer 4, to power the heat generator 5 with a detection element 9, thereby cutting a fuse in an arbitrary voltage condition."

(C) "[0038] The low-melting point metal is also connected to a fuse electrode 2c in FIG. 4, which is arranged between fuse electrodes 2a, 2b to which both ends of the low-melting point metal are connected. The material of the fuse electrode 2c is the same as that of the fuse electrode 2a or 2. Other constitutions are the same as in the above example.

[0039] Details of the example are described below. A conductor pattern shown in FIG. 5 is formed on a polyimide film with a thickness of 25 μm. Carbon paste FC-403R (manufactured by FUJIKURA KASEI CO., LTD., phenolic resin-based) is applied by screen printing between heater electrodes 3a, 3b so as not to cover the fuse electrodes 2a, 2b, and 2c, and is hardened for 30 minutes at 150°C.

[0040] An insulation layer is applied by screen printing so as to cover the whole surface of the carbon paste without covering the fuse electrodes 2a, 2b, and 2c, and is hardened for 30 minutes at 150°C. The formulation of the insulation layer is the same as in the above example.

[0041] A 7mm-by-3mm low-melting point metal with a thickness of 100μm is bonded by heat pressing between the fuse electrodes 2a, 2b, and 2c. ..."

(D) "[0046] The protection element in FIG. 6B is obtained by embedding the fuse resistor and a voltage detection element. When electricity is supplied to the heat generator from the fuse electrode 2a or 2b in FIG. 5, after the low-melting point metal is melted and cut, the electricity supplied to the heat generator is stopped for safety, and the protection element can be used as a protection element for preventing overcharging of the battery.

[0047] Therefore, the circuit (FIG. 6A) indicated in the first example is a voltage detection system configured to bring the heat generator into thermal contact with the low-melting point metal without forming an intermediate electrode, for allowing a current to flow with a predetermined voltage into the heat generator, to melt and cut the low-melting point metal with the heat. In this case, if a battery is connected to a charger, electricity supplied to the heat generator through the detection element is not stopped even after cutting the low-melting point metal regardless of whether the connection part e is connected to the electrode a or the electrode c, and the heat generator continues generating heat, which may cause ignition.

[0048] In the circuit of the example, the protection element is configured to supply electricity to the heat generator via an intermediate electrode through the low-melting point metal at both electrodes f and h. Even when the battery is connected to the charger, electricity supplied to the heat generator can be stopped by melting and cutting the low-melting point metal at two spots."

According to the description of the above matters and drawings, it can be recognized that the following invention (hereinafter referred to as "Invention A-3") is described in Evidence A No. 3.

[Invention A-3]

"A protection element having a heat generator and a low-melting point metal which melts and cuts with heat generated in the heat generator, configured to detect a voltage for operation, the low-melting point metal having fuse electrodes arranged at both ends and an intermediate point, the protection element being configured to supply electricity to the heat generator through the low-melting point metal via an intermediate electrode, to reliably stop the electricity supplied to the heat generator after melting and cutting the low-melting point metal, for preventing overheating."

(3) Evidence A No. 5

The following matters are described by reference to drawings in Evidence A No. 5 (Japanese Utility Model Publication No. H4-36021).

(A) "Claim of Utility Model

A resistor-thermal fuse combination formed by arranging a layered resistor and a layered low-melting point metal body in different positions on an insulating substrate, and a layered high heat conductor on the layered low-melting point metal body via an insulation film, and connecting the layered high heat conductor with the layered resistor so as to transfer heat." (p. 1 the first column l. 1-l. 7)

(B) "<Industrial Application Field>

This device relates to improvement of a resistor-thermal fuse combination." (p. 1 the first column l, 9-l. 11)

(C) <Prior art and problems>

A resistor element with thermal fuses arranged in series is configured to melt and cut the thermal fuses with heat generated by a resistor due to overcurrent, to thereby shut off electricity to be supplied to the resistor, and can protect a circuit from abnormal heating of the resistor.

The resistor element with thermal fuses, as shown in FIG. 4, is well known and is formed by arranging electrodes 21', 22', and 23' on an insulating substrate 1', arranging a layered resistor 3' between the electrodes 21' and 22', arranging a layered low-melting point metal body 4' between the electrodes 21' and 23', and arranging an insulation layer 7' on the insulating substrate 1'. Reference numerals 8' and 8' denote lead conductors.

However, since the heat generated in the resistor 3' is efficiently transferred to the layered low-melting point metal body part 40' of the resistor with thermal fuses near the electrode 21' as a heat transfer path, the layered low-melting point metal body part 40' is heated well, while other low-melting point metal body parts are unlikely to be heated. Therefore, the layered low-melting point metal body is heated non-uniformly, resulting in delay of melt-cutting, and causing unfavorable operability." (p. 1 the first column l. 12 to the second column l. 6)

(D) "<Object of the device>

The object of the device is to heat a layered low-melting point metal body uniformly, to provide a substrate-type resistor-thermal fuse combination with excellent operability." (p. 1 the second column l. 7-l. 10)

(E) "<Configuration of the device>

The resistor-thermal fuse combination according to the device is configured by arranging a layered resistor and a layered low-melting point metal body in different positions on an insulating substrate, a layered high heat conductor on the layered low-melting point metal body via an insulation film, and connecting the layered high heat conductor and the layered resistor so as to transfer heat." (p. 1 the second column l. 11-l. 17)

(F) "<Description of the example>

The device is described as follows by reference to drawings.

FIG. 1A is a schematic diagram illustrating the resistor element with thermal fuses according to the device, and FIG. 1B is a cross-sectional view along b-b in FIG. 1A.

In FIG. 1A and FIG. 1B, reference numeral 1 denotes an insulating substrate, which can employ a ceramic board or heat-resistant plastic board. Reference numerals 21, 22, and 23 denote foil electrodes. Reference numeral 3 denotes a layered resistor, which is arranged between the electrodes 21 and 22. Reference numeral 4 denotes a layered low-melting point metal body (Pb-Sn alloy-based, for example), which is arranged between the electrodes 21 and 23. Reference numeral 5 denotes a layered high heat conductor having heat conductivity much higher than that of the layered low-melting point metal body 4, and is arranged immediately below the layered low-melting point metal body 4 via the insulation film 6. The layered high heat conductor 5 is connected to the electrode 21 and separated from the electrode 23. The same material can be employed to the layered high heat conductor 5 as the electrode 23. Reference numeral 7 denotes the insulation layer arranged on the insulating substrate. Reference numerals 8, 8 denote lead conductors.

In the above, when the layered resistor 3 generates heat due to overcurrent, the heat is transferred to the layered high heat conductor 5 with an electrode 21 as a heat transfer path, to heat the layered low-melting point metal body 4 not only from one end 40 on the side of the electrode 21 but also from immediately below, thereby uniformly heating the layered low-melting point metal body 4.

FIG. 2 illustrates another example of the device where the layered high heat conductor 5 intersects with the intermediate part of the layered low-melting point metal body 4. Reference numeral 6 denotes an insulation film for insulating the layered high heat conductor 5 from the layered low-melting point metal body 4.

FIG. 3 illustrates a thermal fuse with resistance according to the other example of the device. Reference numerals 3 and 4 denote the layered resistor and the layered low-melting point metal body, which are independent from each other. Reference numeral 5 denotes the layered high heat conductor connected to the layered resistor 3 so as to transfer heat, and intersects with the layered low-melting point metal body 4 via the insulation film 6. Reference numerals 81, 81 and 82, 82 denote lead conductors.

In the thermal fuse, the layered resistor 3 is connected to a protected circuit, the layered low-melting point metal body 4 is connected to a relay circuit of the protected circuit, the layered resistor 3 generates heat due to overcurrent of the protected circuit, and the heat melts and cuts the layered low-melting point metal body 4. Accordingly, the layered low-melting point metal body 4 is heated by the layered high heat conductor 5 from immediately below, thereby uniformly heating the layered low-melting point metal body 4 and smoothly melting and cutting the layered low-melting point metal body 4. Thus, the protected circuit can be protected properly." (p. 1 the second column l. 18-p.2 the fourth column l. 11)

(G) "<Effect of the device>

The resistor-thermal fuse combination according to the device is configured, as described above, to uniformly heat a layered low-melting point metal body, and has excellent operation characteristics. The layered resistor and the layered low-melting point metal body are arranged in different positions, thereby stably holding the low-melting point metal body in a normal heat cycle." (p. 2 the fourth column l. 12-l. 18)

(4) Evidence A No. 15

The following matters are described by reference to drawings in Evidence A No. 15 (Japanese Unexamined Patent Application Publication No. H8-161990).

(A) "[0001]

[Industrial Application Field] This invention relates to a protection element using a low-melting point metal body, such as a fuse. Especially, the invention relates to a protection element useful for preventing overvoltage equal to or larger than a predetermined voltage."

(B) "[0002]

[Conventional art] Conventionally, a current fuse which melts and cuts with overcurrent to shut off a current has been used widely as a protection element that uses a low-melting point metal body formed of lead, tin, or antimony. Well-known examples of the above fuse include a claw fuse formed by arranging claws at both ends of a strip low-melting point metal body, a cylindrical fuse formed by inserting a bar-like low-melting point metal body in a glass tube, a chip fuse formed by arranging a lead terminal in a rectangular parallelepiped low-melting point metal body, and the like. A thermal fuse which melts and cuts when exceeding a predetermined temperature is also used as a protection element."

(C) "[0003]

[Problem to be Solved by the Invention] However, any aspect of the above conventional protection elements has difficulty implementing surface mount on a wiring substrate. For this, there is proposed a chip fuse formed by embedding and shielding a fuse in a rectangular parallelepiped and forming a lead terminal of the fuse on the surface of the rectangular parallelepiped resin (Japanese Unexamined Application Publication No. H4-192237). However, even if the fuse is embedded and shielded in the resin, the fuse melts when an overcurrent flows, but may fail to be melt and cut, and the fuse cannot function as a protection element stably.

[0004] A commercially available chip fuse is formed with a thickness of about 2.6 mm, a width of about 2.6 mm, and a length of about 6 mm at least, which is larger than other electronic components mounted on a substrate. Especially, an IC has a thickness of 1 mm in general, while the chip fuse has a thickness of about 2.6 mm, which is significantly larger. The height of the substrate with the fuse mounted thereon is restricted by the chip fuse, thereby preventing reduction of mounting space. There is a need to reduce the thickness of the chip fuse up to about 1 mm.

[0005] With the latest industrial development, there is a need for a protection element which operates with overvoltage, in addition to a conventional current fuse or thermal fuse.

[0006] In a lithium-ion battery, which stands out as a secondary battery of high energy density, dendrites formed on the surface of an electrode due to overcharging significantly reduces battery performance, and there is a need to prevent the battery from being charged in excess of a predetermined voltage in charging. However, no useful protection element to protect overvoltage has been developed. An existing protection mechanism of a lithium-ion battery, which is configured to cause a PTC to generate heat when a current equal to or larger than a prescribed value flows to a battery due to a short circuit, or the like, to melt and cut a fuse, cannot be used for preventing overcharging, actually. Therefore, a new protection element for preventing overcharging, especially a protection element to be used in charging a battery with high

safety, which is unlikely to ignite, is required.
[0007] This invention is aimed at solving the above problem of the conventional art relating to a fuse, and is primarily aimed at providing a new protection element which can prevent overvoltage. The invention is secondarily aimed at downsizing a chip-type protection element, including conventional current fuses, while ensuring stable operation."
(D) "[0008]
[Means for Solving the Problem] The inventors found that an element formed by sequentially laminating a heating element made of an inorganic material, an insulation layer, and a low-melting point metal body on an inorganic substrate is useful as a protection element for preventing overvoltage, and completed the first invention. The inventors also found that a chip-type protection element, including a conventional current fuse, as well as the protection element for preventing overvoltage, can be made compact without impairing the function of the protection element, by arranging a low-melting point metal body on a substrate, shielding the low-melting point metal body with a material having a low-melting point or low-softening point lower than that of the low-melting point metal body, and externally covering it with a gap with an external case, and thus completed the second invention.
[0009] Thus, this invention provides, as the first invention, a protection element including a heating element made of an inorganic material arranged on an inorganic substrate, an insulation layer covering the surface of the heating element, and a low-melting point metal body arranged on the insulation layer.
[0010] This invention provides an overvoltage prevention device using the above protection element, including the protection element and voltage detection means, the voltage detection means detecting a voltage equal to or larger than a predetermined voltage to power the heating element of the protection element, thereby generating heat.
[0011] The invention provides, as the second invention, an anti-overcurrent protection element including a low-melting point metal body arranged on a substrate, an inside shielding part made of a material having a low melting point or low softening point lower than that of the low-melting point metal body to shield the low-melting point metal body, and an outer case covering the inside shielding part with a gap from the inside shielding part."
(E) "[0021] As described above, the protection element of the invention can be formed of a heating element 3 made of an inorganic material arranged on an inorganic substrate 2, an insulating layer 4, and a low-melting point metal body 5, and preferably, as shown in FIG. 2 and FIG. 3, the low-melting point metal body 5 is shielded by an inside shielding part 8 and the outside thereof is covered with an outer case or an outside shielding part.
[0022] Thus, FIG. 2 is a cross-sectional view of a protection element 1b configured by shielding the low-melting point metal body 5 of the protection element 1a in FIG. 1 with the inside shielding part 8 having a low melting point or a low softening point lower than that of the low-melting point metal body 5, and covering the inside shielding part 8 with the outer case 9.
[0023] When the surface of the low-melting point metal body 5 is oxidized, the surface oxidization part of the low-melting point metal body 5 does not melt even if heated to the original melting point, and the low-melting point metal body 5 may fail to be melt and cut in some cases. However, the low-melting point metal body 5 is shielded by

the inside shielding part 8, thereby preventing surface oxidization of the low-melting point metal body 5, and the low-melting point metal body 5 can be reliably melted and cut when heated to a predetermined temperature. Since the inside shielding part 8 is formed of a material having a low melting point or low softening point lower than that of the low-melting point metal body 5, melt-cutting of the low-melting point metal body 5 is not inhibited by shielding the low-melting point metal body 5 with the inside shielding part 8.

[0024] Preferably, the inside shielding part 8 has functions of removing a metal oxide film formed on the surface as well as preventing surface oxidization of the low-melting point metal body 5. Thus, preferably, a shielding material having a function of removing a metal oxide film, such as an organic acid or an inorganic acid, is used as a shielding material for the inside shielding part 8. Especially, a non-corrosive solid flux containing abietic acid as a principal component is preferable. The reason is that the abietic acid, which is solid and inactive at a room temperature and active when melting at 120°C to exert a function of removing metal oxide, secures melt-cutting when the low-melting point metal body 5 is heated to a predetermined temperature, and that storage stability of the protection element can be improved. When the inside shielding part 8 is formed with solid flux, the solid flux is melted with heat without using a solvent and the melted flux is applied onto the low-melting point metal body 5, preferably, in order to prevent cratering.

[0025] The inside shielding part 8 is formed with a thickness of about 10 to 100 μm, preferably, depending on the kind of the shielding material, in view of preventing surface oxidization of the low-melting point metal body 5 or removing a surface oxidized film."

(F) "[0026] The outer case 9 is arranged in order to prevent a melted material from flowing out from the protection element when the low-melting point metal body 5 or the inside shielding part 8 is melted. The outer case 9 is arranged preferably with a gap 10 from the inside shielding part 8, as shown in FIG. 2. A vertical size d1 of the gap is about 50-500 μm, and a horizontal size d2 thereof is about 0.2-1.0 mm, preferably. When the low-melting point metal body 5 or the inside shielding part 8 is melted, the gap 10 of the above size can secure the space where the melted material moves, thereby reliably causing melt-cutting.

[0027] No particular limitation is imposed on a constituent material of the outer case 9. Considering a housing shape having a gap with the inside shielding part 8 and heat resistance or flame resistance, 4.6-nylon with a flame retardant added thereto or liquid crystal polymer is preferably used.

[0028] As described above, when the low-melting point metal body 5 is shielded with the inside shielding part 8 and covered with the outer case 9 with a gap 10 from the inside shielding part 8, the surface of the low-melting point metal body 5 can be protected, reliability of melt-cutting can be ensured when the low-melting point metal body 5 is heated to a predetermined temperature, and the overall thickness D of the protection element can be 1 mm or less. Therefore, the protection element 1b can be an excellent protection element that satisfies operation reliability and downsizing requirements as a protection element.

[0029] The configuration where the low-melting point metal body 5 is shielded with the inside shielding part 8 and covered with the outer case 9 with a gap 10 from the inside shielding part 8 can be applied to a protection element having no heating element 3.

The protection element 1b shown in FIG. 2 includes the heating element 3 so as to function in an overvoltage prevention device as described later. Even in a conventional anti-overcurrent chip-type fuse having no heating element 3, the configuration where a low-melting point metal body is shielded with an inside shielding part and covered with an outer case with a gap improves operating reliability as a protection element, and is useful for downsizing of the element, thereby reducing the thickness of a chip-type fuse up to about 50%. Thus, this invention also includes an anti-overcurrent protection element formed of a low-melting point metal body arranged on a substrate, an inside shielding part formed of a material having a low-melting point or low-softening point lower than that of the low-melting point metal body to shield the low-melting point metal body, and an outer case covering the inside shielding part with a gap from the inside shielding part."

(G) "[0045] Example 2

The protection element configured as shown in FIG. 2 was manufactured by, in the protection element manufactured as Example 1, applying paste flux (HA·78·TS-M, manufactured by TARUTIN Co. LTD.) on the low-melting point metal body 5 with a thickness of 0.5 mm to form the inside shielding part 8, and bonding the outer case 9 molded out of liquid polymer (G-530, manufactured by Nisseki chemical Corporation) with an epoxy-based adhesive.

...

[0048] Evaluation

When a digital multi-meter is connected to the terminals 7a, 7b for low-melting point metal body and a voltage of 4 V is applied between the terminals 6a, 6b for the heating element, while checking a resistance value, it is confirmed that the low-melting point metal body 5 in each of the protection elements of Example 2 and Example 3 is melted and cut within 60 seconds. No leakage of the low-melting point metal body is observed from the outer case 9 or the outside shielding part 11."

(H) "[0050]

[Effect of the Invention] The first invention can provide a high-security protection element which prevents overvoltage. The second invention can provide a compact chip-type protection element which ensures stable operation."

(5) Evidence A No. 16

The following matters are described by reference to drawings in Evidence A No. 16 (Japanese Unexamined Patent Application Publication No. H9-17302).

(A) "[0010]

[Examples] The example of the Invention is described in detail below with reference to the drawings. (A) in FIG. 1 is a plan view formed by partially cutting one example of a flat thermal fuse according to the Invention. (B) in FIG. 1 and (C) in FIG. 1 are cross-sectional view B-B and cross-sectional view C-C in (A) of FIG. 1, respectively. In (A) to (C) in FIG. 1, reference numeral 1 denotes an insulating substrate, which employs a hard thermoplastic sheet (a heat-sealable polyimide sheet or polyester sheet, or the like). Reference numerals 2, 2 denote a pair of electrodes fixed to the insulating substrate 1, formed by thermally fixing a tip 2 of a band-shape conductor 20 extruded with a square contour from a back side of the insulating substrate 1, to expose the square extrusion part 2 on the surface of the insulating substrate 1. Reference numeral 3 denotes a low-melting point metal body having both ends 31, 31 joined to the electrodes 2, 2 by welding. Reference numeral 4 denotes flux which is applied to cover the low-melting point metal body 3. Reference numeral 5 denotes an insulation external coat coating the insulating substrate1 to cover the electrodes 2, 2 and the low-melting point metal body 3, which can employ heat seal coating of, for example, a thermoplastic film (a heat-sealable polyimide film or polyester film, or the like) (only a peripheral part is heat-sealed so as not to melt the low-melting point metal body). Reference numeral 6 denotes an elastic body interposed between a connection part between one 2 of the electrodes 2, 2 and the low-melting point metal body, and an inside surface of the external coat 5 in a compressed state, which can employ a silicone rubber foam, for example."

(B) "[0012] (A) in FIG. 2 is a plan view formed by partially cutting another example of a flat thermal fuse according to the Invention, and (B) in FIG. 2 is a cross-sectional view B-B in (A) of FIG. 2. In (A) and (B) of FIG. 2, reference numeral 1 denotes an insulating substrate with good heat conductivity, such as a ceramic board. Reference numerals 2, 2 denote a pair of electrodes fixed to the insulating substrate 1, which can be formed by printing/baking conductive paste, such as silver paste. Reference numerals 20, 20 denote lead wires connected by welding, or the like, to the electrodes 2, 2. Reference numeral 3 denotes a low-melting point metal body having both ends 31, 31 joined to the electrodes 2, 2 by welding, or the like. Reference numeral 4 denotes flux applied to cover the low-melting point metal body 3. Reference numeral 5 denotes an insulation external coat coating the insulating substrate 1 to cover the electrodes 2, 2 and the low-melting point metal body 3, and can be formed by dropping epoxy resin to be hardened at ordinary temperature or applying epoxy resin by dripping to be hardened at ordinary temperature."

(C) "[0014]

[Effect of the Invention] In the flat thermal fuse according to the Invention, the low-melting point metal body is pressed when actuated due to an elastic body or a foaming layer interposed between the low-melting point metal body and the inner surface of the external coat. An oxide film on the low-melting point metal body is broken by a pressing force when the low-melting point metal body in the oxide film melts, thereby allowing reliable operation at a melting point of the low-melting point metal body, and eliminating difference of operation temperature. Since the oxide film is broken by pressure at a low-melting point metal body end on one electrode, even if molten low-melting point metal remains immediately under the pressing position, the remaining metal never reduces insulation between the cut molten low-melting point metals. Electricity can be shut off after melt-cutting the low-melting point metal body quickly by urging disappearance of arc between them. Therefore, according to the Invention, an alloy flat thermal fuse which ensures reliable and quick operation can be provided."

(6) Evidence A No. 17

The following matters are described by reference to drawings in Evidence A No. 17 (Japanese Unexamined Patent Application Publication No. H9-231897).

(A) "[0013] Further protection of the link is typically achieved by encapsulating the link and the deoxidant in some type of housing or encapsulant. The housing may take the form of a much larger tube surrounding the link, or may simply be a coating applied directly over the top of the deoxidant where the fuse link is attached to a flat substrate. Sometimes a cover or cap may be applied over the link and deoxidant, to act as an environmental barrier."

(7) Evidence A No. 18

The following matters are described by reference to drawings in Evidence A No. 18 (Japanese Unexamined Patent Application Publication No. H7-230747).

(A) "[0008] However, according to the result of an experiment of the inventors on operation characteristics of a substrate-type thermal fuse with resistance, in the single-sided substrate-type thermal fuse with resistance shown in (A) and (B) of FIG. 7, as expected, variability of operation characteristics is negligible, while in the double-sided substrate-type thermal fuse with resistance shown in (A) to (D) of FIG. 8, the variability of operation characteristics is larger than expected.

[0009] The inventors investigated the cause thereof. In the double-sided substrate-type thermal fuse with resistance, the epoxy resin layer is formed by dripping, and gelation based on hardening of an epoxy resin bath advances with time, to change viscosity of the resin bath and dip coat thickness, thereby changing the volume of the insulator in the thermal fuse with resistance, and varying heat capacity. Therefore, in the thermal fuse with resistance, when heat resistance of a heat transfer path from the resistance to the thermal fuse element is R, and heat capacity is C, a heat increase speed of the thermal fuse element is evaluated by RC, and the heat capacity C is a function of the volume of insulator. The variability of dip coat thickness causes variability of temperature increase speed of the thermal fuse element, or operation characteristics, accordingly. Against this, in the single-sided substrate-type thermal fuse with resistance, since the amount of epoxy resin per drop can be measured, variability of C can be eliminated.

[0010] The object of the Invention is to reduce or prevent variability of operation characteristics of a thermal fuse with resistance formed by arranging a thermal fuse element on one side of an insulating substrate and a film resistor on the other side of the substrate.

[0011]

[Means for Solving the Problem] The thermal fuse with resistance according to the Invention is configured by arranging a fuse element from a low-melting point soluble metal piece on one side of a heat-conductive insulating substrate, arranging a film resistor on the other side of the substrate, covering the body formed by connecting lead wires to each of the fuse element and the film resistor, with an open-bottomed case, so that the fuse element of the substrate faces the top surface in the case, and filling a curable insulating material in the case. When the central part of the top surface of the case is projected by bringing other portions of the top surface of the case into contact with the insulating substrate, the fuse element can be arranged in the projected part.

[0012] The configuration of the Invention is described in detail below with reference to the drawings. (A) in FIG. 1 is a plan view of a resistance/thermal fuse body to be used in the Invention, (B) in FIG. 1 is a bottom view of the fuse body, (C) in FIG. 1 is a cross-sectional view C-C in (A) of FIG.1, and (D) in FIG. 1 is a cross-sectional view D-D in (B) of FIG. 1. In (A) to (D) of FIG. 1, reference numeral 11 denotes a heat-conductive insulating substrate, which is a ceramic substrate, preferably. Reference numerals 12, 12 denote a pair of film electrodes arranged on one side of the insulating substrate 11, having a lead-wire attachment part 121 and a thermal-fuse element attachment part 122. The film electrodes symmetrical with respect to a vertical center line a-a are arranged vertically symmetrical with respect to a horizontal center line b-b. The film electrodes 12 may be formed by baking conductive paint by screen printing, for example. Reference numeral 13 denotes a lead wire welded or brazed to each of the film electrodes 12. Reference numeral 14 denotes a thermal fuse element, bridged along the vertical center line a-a by welding between the film electrodes, using a round or rectangular (formed by flattening a round wire) low-melting point soluble alloy wire. Reference numeral 15 denotes flux coated on the thermal fuse element 14, including rosin as a principal component.

[0013] Reference numerals 16, 16, 16 and 16 denote two pairs of film electrodes arranged on the other side of the insulating substrate 11, symmetrical with respect to the vertical center line a-a, each having a band-shaped film electrode 162 with a lead-wire attachment part 161 arranged on one end so that the lead-wire attachment part 161 is located at both ends of the insulating substrate 11. The film electrodes 16 are also formed by the above printing method. Reference numeral 17 denotes a film resistor arranged between the pair of electrodes 16, 16 and formed by baking on the other side of the insulating substrate 11, and can be formed by printing/baking resistive paint (a mixture of resistive particles and a binder, the resistive particle using powder of oxidized metal, such as ruthenium oxide, or powder of high-resistive metal, such as nickel or iron, the binder using glass frit). Reference numeral 18 denotes a protection film covering the film resistors 17, 17, uses a glass frit which is more flexible and has a lower melting point than the above glass frit, and effectively prevents cracks of the film resistor when a resistance value thereof is adjusted by trimming the film resistor. Reference numeral 19 denotes a lead wire connected to the film electrode 16 by welding or brazing.

[0014] (A) in FIG. 2 is a cross-sectional view illustrating one example of the thermal fuse with resistance according to the Invention, and (B) in FIG. 2 is a cross-sectional view B-B in (A) of FIG. 2. In (A) and (B) of FIG. 2, reference numeral 1 denotes the body of the thermal fuse with resistance described above. Reference numeral 2 denotes an open-bottomed case, having a frame 2 around a top board 21, configured to cover the body 1 of the thermal fuse with resistance with the fuse element 14 facing the top surface in the case, and to draw the lead wires 13, 19 from each of V notches 221 arranged in the frame 22.

[0015] An inner frame of the frame 22 of the case 2 is set to cover an outer frame of the insulating substrate 11 of the body 1 of the thermal fuse with resistance in a tight-fit manner, substantially without leaving a gap. Vertical and lateral sizes of the inner frame are defined to be 1.1 times or less, preferably 1.07 times or less, with respect to the vertical and lateral sizes of the insulating substrate. Reference numeral 3 denotes an insulating material filled and solidified in the case 2, formed by dripping measured epoxy resin liquid with viscosity of about 20000 to 200000 cps into the case 2, with the open side of the case up, ... to be cured at ordinary temperature."

(B) "[0024]

[Operation] In the thermal fuse with resistance, when heat resistance of a medium on a heat transfer path from the film resistor to the thermal fuse element is R, and heat capacity is C, heat increase speed of the thermal fuse element due to the heat generated in the film resistor is, as described above, evaluated by RC, and the heat increase speed of the thermal increase speed varies with C.

[0025] Variability of C relates to variability of the volume of insulator primarily. Thus, in the thermal fuse with resistance according to the Invention, since the insulator can be formed by dropping a measured amount of curable insulating material into the case, the volume of the insulator can be made constant with high accuracy, and the volume of the case and the insulating substrate can be also made constant with high accuracy, thereby favorably eliminating variability of the volume of insulator."

2. Regarding Invention 1

(1) Comparison

Comparing Invention 1 with the Cited invention, according to the functions thereof, the "insulating substrate (1) formed of a ceramic board" in the latter corresponds to the "ceramic substrate" in the former, the "film low-melting point metal bodies (61, 62) on "the other side" in the latter correspond to the "low-melting point alloy body" on "one side" in the former, the "film resistors (31, 32)" on "one side" in the latter correspond to the "heating element" on "the other side" in the former, the "thermal fuse with resistance" in the latter corresponds to the "thermal fuse with resistance" in the former, the description, the film low-melting point metal bodies (61, 62) being formed in a "film shape" in the latter corresponds to the description, the low-melting point alloy body being "flat" in the former, the description, the film low-melting point metal bodies (61, 62) arranged in the "same positions" on the other side of the insulating substrate (1) as the film resistors (31, 32), in the latter, corresponds to the description, the low-melting point alloy body being arranged in a "position opposite" the heating element on one side of the ceramic substrate, in the former, and the description, "the fluxes (71, 72) are arranged around the film low-melting point metal bodies (61, 62)," in the latter corresponds to the description, "the flux arranged around the low-melting point alloy body," in the former.

The respective ends of the film low-melting point metal bodies (61, 62), connected with film conductor (8) and the film auxiliary conductors (91, 92), in the latter, according to the functions thereof, correspond to the "electrodes" at both ends of the low-melting point alloy body in the former. The film low-melting point metal bodies (61, 62) in the latter having "both ends connected to the electrodes" correspond to the low-melting point alloy body in the former having "both ends and an intermediate part connected to electrodes" only when "both ends are connected to electrodes."

Thus, the corresponding features and different features between them are as follows.

[Corresponding feature 1]

"A thermal fuse with resistance formed by arranging a low-melting point alloy body on one side of a ceramic substrate and a heating element on the other side, and configured to melt and cut the low-melting point alloy body with heat via the ceramic substrate by applying electric power to the heating element, to shut off a circuit, the low-melting point alloy body being flat and arranged in a position opposite the heating element on one side of the ceramic substrate, having both ends connected to electrodes, wherein flux is arranged around the low-melting point alloy body."

[Different feature 1]

In the Invention 1, the low-melting point alloy body has "an intermediate part connected to an electrode," and is configured so that "the heating element being

powered via the electrode of the intermediate part." In the Cited invention, no electrode is arranged in the intermediate part of the film low-melting point metal body, and the film low-melting metal body is not used in powering the film resistor.
[Different feature 2]
The Invention 1 includes the matter, "a case is brought into airtight contact with the ceramic substrate, to protect the flux from an outdoor air environment." The Cited invention does not include the above matter.

(2) Judgment
The different features are examined.
[Regarding the Different feature 1]
A. The Cited invention and Invention A-3 belong to the same technical field in the point of a thermal fuse or a protection element which melts and cuts a low-melting point metal with heat generated in a resistor. Invention A-3 aims to configure a protection element that detects voltages from the low-melting point metal and the heating element.
Thus, it can be recognized that a person skilled in the art can easily conceive of applying a technology of arranging an electrode in the intermediate part of the low-melting point metal in the Invention A-3, in order to detect a voltage for reliable operation, to the Cited invention which is a thermal fuse formed of a heating element and a low-melting point metal body similar to Invention A-3, and powering a heating element via the electrode, to be the matters specifying the invention of the Invention 1 according to Different feature 1.
B. The demandee alleges in the written reply dated April 5, 2013 that the invention described in Evidence A No. 3, which uses a film insulation layer for insulation between a heating element and a low-melting point metal, constitutes an obstructing factor of application to the Cited invention (see p. 13 "(1-1)", p. 14 "(1-2)").
However, the circuit configuration of the Invention A-3 "the low-melting point metal having fuse electrodes arranged at both ends and an intermediate point", and "configured to supply electricity to the heat generator through the low-melting point metal via an intermediate electrode" does not necessarily use a film insulating layer for insulation between the heat generator and the low-melting point metal, or the circuit configuration does not premise the structure of an insulation layer. Accordingly, the above description is not an obstructing factor.
The demandee alleges also in the written reply that there is an obstructing factor in combining the Cited invention which detects overcurrent with the invention described in the Evidence A No. 3 which detects a voltage (see p. 15 "(1-3)").
However, as described above, since the Cited invention and Invention A-3 belong to the same technical field and employ the same structure, it can be recognized that a person in contact with both inventions can easily conceive of the combination.

[Regarding the Different feature 2]
A. According to 1. (4), it can be recognized that Evidence A No. 15 discloses: (i) as shown in FIG. 2, the protection element formed of the heating element 3 arranged on the substrate 2, the insulation layer 4 covering the surface thereof, and the low-melting point metal body 5 arranged on the insulation layer, configured to shield the low-melting point metal body with the inside shielding part 8 and cover the inside shielding part 8 with the outer case 9 (paragraphs [0008], [0021]; (ii) the outer case 9 being

arranged for preventing the melted material of the low-melting point metal body 5 or the inside shielding part 8, when melted, from leaking from the protection element (paragraph [0026]); (iii) the shielding material of the inside shielding part 8 being preferably a non-corrosive solid flux containing abietic acid as a principal component (paragraph [0024]), and the constituent material of the outer case 9, which is not particularly limited but preferably 4.6-nylon with a flame retardant added thereto or liquid crystal polymer (paragraph [0027]; (iv) the configuration of shielding the low-melting point metal body 5 with the inside shielding part 8 and covering it with the outer case 9 with a gap 10 from the inside shielding part 8, protecting the surface of the low-melting point metal body 5, and securing melt-cutting when the low-melting point metal body 5 is heated to a predetermined temperature (paragraph [0028]); (v) the configuration of the conventional anti-overcurrent chip fuse having no heating element 3, having a low-melting point metal body shielded by the inside shielding part and covered with the outer case with a gap, improving operation reliability as a protection element and useful for downsizing the element (paragraph [0029]); and (vi) the experimental result that the low-melting point metal body 5 is melted and cut within 60 seconds with a voltage of 4 V applied between the terminals 6a and 6b for heating element connected to the protection element and that no leakage of the low-melting point metal body is observed from the outer case 9 or the outside shielding part 11, when the protection element configured as shown in FIG. 2, as "Example 2," is manufactured by applying paste flux with on the low-melting point metal body 5 a thickness of 0.5 mm to form the inside shielding part 8, and bonding the outer case 9 molded out of liquid crystal polymer with an epoxy-based adhesive (paragraphs [0045], [0048]).

According to the above disclosed matters and FIG. 2 of Evidence A No. 15, it can be recognized that the outside case (outer case 9) of the protection element in FIG. 2 is bonded to the substrate with adhesive to prevent melted and cut low-melting point metal and flux from leaking to the outside from the inside of the outer case.

At the time of filing of the application, in the thermal fuse having a soluble alloy body and flux covering it, it can be recognized that it has been well known that the thermal fuse is housed in a case with an open end shielded, for preventing deterioration of the soluble alloy body and flux, to protect the soluble alloy body and flux in an airtight state (in the court decision, as means for supporting the well-known art, a microfilm of Japanese Utility Model Application No. S60-180572 (Japanese Unexamined Utility Model Application Publication No. S62-88330) (Specification p. 5 l. 2-l. 10, p. 5 l. 13-p. 6 l. 8, FIG. 1 and FIG. 2), and Japanese Unexamined Patent Application Publication No. H5-281867 (paragraphs [0037]-[0039], [0042]-[0043], and FIG. 3) are presented).

In light of the above well-known art, it is recognized that a person skilled in the art accessing Evidence A No. 15 could understand that the low-melting point metal body and flux are protected from an outdoor environment outside the outer case due to an airtight state between the inside and outside of the outer case so as not to circulate gas inside and outside of the outer case, formed by bonding the outside case (outer case 9) of the protection element in FIG. 2 to the substrate with adhesive.

Although there is no explicit description in Evidence A No. 15 about the airtight state between the inside and outside of the outer case due to bonding the outer case in FIG. 2 to the substrate, there is also no description indicating absence of the above structure. Therefore, the absence of the explicit description does not hinder the recognition.

Thus, it can be recognized that the protection element in Evidence A No. 15 is configured to protect the flux from the outdoor environment due to the outer case being in airtight contact with the substrate with adhesive. Accordingly, it can be recognized that the configuration of the Invention A according to the Different feature 2 is disclosed in Evidence A No. 15.

B. In this regard, the demandee alleges in the written reply dated February 7, 2014 that there is a description in Evidence A No. 15 about the case 9 which is used for preventing leakage of a melted material from the protection material, while there is no description or indication about the case which comes into "airtight contact" with the ceramic substrate to protect the flux from the outdoor environment (p. 4 "6. 1. 2").

However, as described in A, it can be recognized that the protection element in FIG. 2 of Evidence A No. 15 is configured to protect the flux from the outdoor environment due to the outside case (outer case 9) being in contact with the substrate with adhesive. The absence of the explicit description in Evidence A No. 15 about the airtight structure between the inside and outside of the outer case due to bonding between the outer case and the substrate in FIG. 2 does not hinder the recognition.

Thus, the allegation of the demandee cannot be accepted.

C. In light of the above, the easily-conceived property of the Different feature 2 is examined below.

According to 1. (1), it can be recognized that Evidence A No. 2 discloses the following matters: (i) a substrate-type thermal fuse with resistance, which is formed by arranging a film resistor on one side of an insulating substrate and a film low-melting point metal body on the other side of the insulating substrate, is well-known, the thermal fuse with resistance being configured to transmit the heat generated in the film resistor due to overcurrent to the film low-melting point metal body, to melt and cut the low-melting point metal body, and to shut off the overcurrent by cutting, while causing poor operating characteristics due to poor heat transfer characteristics of a heat path where the heat generated in the film resistor is transferred to the film low-melting point metal body via the thickness of the insulating substrate (Indication C); (ii) the object of the Cited invention is to improve heat transfer characteristics, thereby improving operation characteristics, in the substrate-type thermal fuse with resistance (Indication D); (iii) the thermal fuse with resistance according to the Cited invention is configured so that the film low-melting point metal bodies are heated by two film resistors (heat sources), thereby achieving excellent heat transfer efficiency and guaranteeing quick operability of the fuse, and the film low-melting point metal bodies are arranged for the film resistors, respectively, thereby achieving uniform weight heat distribution based on each of the heat sources, uniform distribution of distortion generated in the fuse during heat cycle, and ensuring stability under severe heat cycles (Indication (F) and (G)).

As described in A, according to Evidence A No. 15 (i) that discloses when the low-melting point metal body 5 is shielded with the inside shielding part 8 and covered with the outer case 9 with a gap 10 from the inside shielding part 8, the surface of the low-melting point metal body 5 can be protected, reliability of melt-cutting can be ensured when the low-melting point metal body 5 is heated to a predetermined temperature, and (ii) at the time of filing of the application, in the thermal fuse having a soluble alloy body and flux covering it, it could be recognized that the fact has been well-known that the thermal fuse is housed in a case with an open end shielded, for preventing deterioration of the soluble alloy body and flux, to protect the soluble alloy body and flux in an airtight manner, it can be recognized that a person skilled in the art accessing Evidences A No. 2 and No. 15 has motivation to apply the outer case of Evidence A No. 15 to the low-melting point metal body in the Cited invention, in order to prevent deterioration of the low-melting point metal body and flux in the Cited invention and improve operating characteristics by preventing leakage of melted material, and a person skilled in the art could easily conceive of the configuration of the Invention 1 according to the Different feature 2.

[Regarding the effect of Invention 1]

The effect produced by the matters specifying the invention of Invention 1 cannot be regarded as a particularly distinguished feature, either, on the basis of the Cited invention, technical matters described in Evidence A No. 3, technical matters described in Evidence A No. 15, and the above well-known art.

Therefore, Invention 1 can be regarded as an invention which could be easily invented by a person skilled in the art, on the basis of the Cited invention, the technical matters described in Evidence A No. 3, the technical matters described in Evidence A No. 15, and the above well-known technology.

3. Regarding Invention 2

(1) Comparison

Invention 2 corresponds to the invention formed by adding the matter, "the intermediate part of the low-melting point alloy body being supported by a high heat conductor arranged on the ceramic substrate," excluding the matter, "flux is arranged around the low-melting point alloy body for airtight contact between a case and the ceramic substrate, to protect the flux from an outdoor air environment" of Invention 1.

The inventions correspond to each other in the following points, and differ from each other in the following points in addition to the Different feature 1 indicated in 2. (1).

[Corresponding feature 2]

"A thermal fuse with resistance formed by arranging a low-melting point alloy body on one side of a ceramic substrate and a heating element on the other side, and configured to melt and cut the low-melting point alloy body with heat via the ceramic substrate by applying electric power to the heating element, to shut off a circuit, the low-melting point alloy body being flat and arranged in a position opposite the heating element on one side of the ceramic substrate, having both ends connected to electrodes."

[Different feature 3]

The Invention 2 is configured so that "the intermediate part of the low-melting point alloy body being supported by a high heat conductor arranged on the ceramic substrate." The Cited invention does not include the above configuration.

(2) Judgment

The judgment on the Different feature 1 is as indicated in 2. (2). A person skilled in the art can easily conceive of the invention. The Different feature 3 is examined below.

A. According to 1. (3), it can be recognized that the following matters are disclosed in Evidence A No.5.

The resistor element with thermal fuses having a layered resistor and a layered low-melting point metal body arranged in different positions on an insulating substrate, as shown in FIG. 4, formed by arranging electrodes 21', 22', and 23' on the insulating substrate 1', arranging layered resistor 3' between the electrodes 21' and 22', arranging the layered low-melting point metal body 4' between the electrodes 21' and 23', and arranging an insulation layer 7' on the insulating substrate 1', is well-known. Since the heat generated in the resistor 3' is efficiently transferred to the layered low-melting point metal body part 40' of the resistor with thermal fuses near the electrode 21', using the electrode 21' as a heat transfer path, the layered low-melting point metal body part 40' is heated well, while other low-melting point metal body parts are unlikely to be heated. Therefore, the layered low-melting point metal body is heated non-uniformly, resulting in delay of melt-cutting, and causing unfavorable operability (Indication (C)).

The invention according to Evidence A No. 5 employs, in the resister element with thermal fuses, as shown in FIG. 1 A, FIG. 2, and FIG. 3, a configuration where the layered high heat conductor 5 is arranged via the insulation film 6 immediately below the layered low-melting point metal body 4 or the intermediate part thereof. When the layered resistor 3 generates heat, the heat is transferred to the layered high heat conductor 5 using an electrode 21 as a heat transfer path, to heat the layered low-melting point metal body 4 not only from one end 40 on the side of the electrode 21 but also from immediately below the part supported by the layered high heat conductor 5, thereby uniformly heating the layered low-melting point metal body 4, and improving operating characteristics (Indication (F), (G)).

B. According to the disclosed matters in A, a person skilled in the art accessing Evidence A No. 5 can be regarded to understand that the heat transfer path of the layered resistor 3 is controlled by arranging the layered high heat conductor 5 via the insulation film 6 immediately below the layered low-melting point metal body 4 or the intermediate part thereof, as shown in FIG. 1A, FIG. 2, and FIG. 3, in the resistor element with thermal fuses with the layered resistor and the layered low-melting point metal body arranged in different positions on the insulating substrate, to heat the layered low-melting point metal body 4 not only from one end 40 on the side of the electrode 21 but also from immediately below the part with the layered high heat conductor 5 arranged thereon, thereby uniformly heating the layered low-melting point metal body 4, resulting in preventing delay of melt-cutting and improving operating characteristics.

In evidence A No. 5, it can be said that a technology is disclosed that the heat transfer path of the heat generated in the layered resistor 3 is controlled by arranging the layered high heat conductor 5 via the insulation film 6 immediately below the layered low-melting point metal body 4 or the intermediate part thereof, to control the location heated in the layered low-melting point metal body 4 so as to be heated also immediately below the part with the layered high heat conductor 5 arranged thereon, and that the technology can heat the layered low-melting point metal body 4 uniformly, thereby preventing delay of melt-cutting and improving operating characteristics.

C. In light of the above, the easily-conceived property of the Different feature 3 is examined below.

As described in 2. (2), it can be said that a person killed in the art could easily conceive of applying to the Cited invention the technology of Invention A-3 ("A protection element having a heat generator and a low-melting point metal which melts and cuts with heat generated in the heat generator, configured to detect a voltage for operation, the low-melting point metal having fuse electrodes arranged at both ends and an intermediate point, the protection element being configured to supply electricity to the heat generator through the low-melting point metal via an intermediate electrode, to reliably stop the electricity supplied to the heat generator after melting and cutting the low-melting point metal, for preventing overheating"), to be the matters specifying the invention (the configuration where "the intermediate part" of the low-melting point alloy body is "connected to electrodes" and "the heating element is powered via the electrode of the intermediate part") of Invention 1.

As described in 1. (1), Evidence A No. 2 discloses that the thermal fuse with resistance according to the Cited invention aims to improve operating characteristics by improving heat transfer efficiency (Indication (D)) in order to address the problem that the substrate-type thermal fuse with resistance, which is formed by arranging a film resistor on one side of an insulating substrate and a film low-melting point metal body on the other side of the insulating substrate, transmits the heat generated in the film resistor to the film low-melting point metal body via the thickness of the insulating substrate, causing poor heat transfer characteristics and poor operating characteristics (Indication (C)).

Furthermore, as described in B, Evidence A No. 5 discloses the technology of arranging the layered high heat conductor 5 via the insulation film 6 immediately below the layered low-melting point metal body 4 and the intermediate part thereof, in the resister element with thermal fuses with the layered resistor and the layered low-melting point metal body in different positions on the insulating substrate, to control the heat transfer path of the layered resistor 3, and controlling the location to be heated of the layered low-melting point metal body 4 so as to be heated also from immediately below the part with the layered high heat conductor 5 arranged thereon, the technology allowing uniform heating of the layered low-melting point metal body 4, thereby preventing delay of melt-cutting and improving operating characteristics.

The Cited invention is a substrate-type thermal fuse with resistance having a film resistor formed on one side of an insulating substrate and a film low-melting point metal body formed on the other side. The resistor element with thermal fuses described in Evidence A No. 5 is a resistor element with thermal fuse having a layered resistor and a layered low-melting point metal body arranged in different positions on an insulating substrate. It is recognized that they are different in arrangement of the film resistor (layered resistor) and the film low-melting point metal body (layered low melting point metal body) with respect to the insulating substrate, while they correspond to each other in the technical field in terms of a thermal fuse with resistance, and have the same technical problem that aims to improve heat transfer characteristics of the heat transfer path for transferring the heat generated in the film resistor to the film low-melting point metal body and improve operating characteristics.

Therefore, it can be recognized that a person skilled in the art accessing Evidences A No. 2, No. 3, and No. 5 could easily conceive of the configuration of Invention 2 according to the Different feature 3 ("the intermediate part of the low-melting point alloy body is supported by the high heat conductor arranged on the ceramic substrate"), due to the motivation to apply the technology of arranging the layered high heat conductor 5 immediately below the intermediate part of the layered low-melting point metal body 4 disclosed in Evidence A No. 5, in order to improve heat transfer characteristics of the heat transfer path for transferring the heat generated in the film resistor in the Cited invention to the film low-melting point metal body, prevent delay of melt-cutting, and improve operating characteristics, in applying the technology of Invention A-3 to the Cited invention to be the configuration where "the intermediate part" of the film low-melting point alloy body is "connected to electrodes" and "the heating element is powered via the electrode of the intermediate part."

D. The demandee alleges in the written reply dated April 5, 2013 that there is no motivation for combining Evidence A No. 2 with Evidence A No. 5, from the viewpoint of the problem, due to the absence of description or indication in Evidence A No. 2 about the problem that the low-melting point metal is partially heated well but is difficult to be heated on the other parts, unlike Evidence A No. 5, and that it cannot be said that a person skilled in the art could easily conceive of combining Evidence A No. 2 with Evidence A No. 5, due to the complete difference in function of the invention and operation between the invention of Evidence A No. 2 and the invention of Evidence A No. 5 (p. 19 "B-2"). However, as described in C, it can be recognized that the Cited invention and the resistor element with thermal fuses described in Evidence A No. 5 correspond to each other not only in technical field but also in the point of improving heat transfer characteristics of the heat transfer path for transferring the heat generated in the film resistor to the film low-melting point metal body and improving operating characteristics. It can be said that a person skilled in the art accessing Evidences A No. 2, No. 3, and No. 5 has a motivation to apply the technology of arranging the layered high heat conductor 5 immediately below the intermediate part of the layered low-melting point metal body 4 disclosed in Evidence A No. 5, in order to improve heat transfer characteristics of the heat transfer path for transferring the heat generated in the film resistor in the Cited invention to the film low-melting point metal body, prevent delay of melt-cutting, and improve operating characteristics, in applying the technology of Invention A-3 to the Cited invention.

Generally, in applying another cited invention or technical matters to the primary cited invention, it is natural to rationally modify the structure or adjust/adapt functions, as necessary, without combining the shape or structure indicated in the cited invention or the technical matters. In applying the technology described in Evidence A No.5 to the Cited invention, the configuration of the layered high heat conductor is combined immediately below the intermediate part of the low-melting point alloy body in the Cited invention. Thus, the allegation of the demandee cannot be accepted.

The effect produced by the matters specifying the invention of the Invention 2 cannot be regarded as a particularly distinguished feature, either, on the basis of the Cited invention, and technical matters described in Evidences A No. 3 and No. 5.

Therefore, the Invention 2 can be regarded as an invention which could be easily invented by a person skilled in the art, on the basis of the Cited invention, and the technical matters described in Evidences A No. 3 and No. 5.

No. 8 Closing

As described above, the demandant should not be granted a patent for Inventions 1 and 2 under the provisions of Article 29(2) of the Patent Act. The Patent should be invalidated under the provisions of Article 123(1)(ii) of the Patent Act.

One half of the costs in connection with the trial decision shall be borne by the demandant, and one half shall be borne by the demandee, including the conclusion of the first trial decision, under the provisions of Article 64 of the Code of Civil Procedure which is applied mutatis mutandis in the provisions of Article 169(2) of the Patent Act.

Therefore, the trial decision shall be made as described in the conclusion.

June 9, 2015

Chief administrative judge: NIINOMI, Takeshi
Administrative judge: UJIHARA, Yasuhiro
Administrative judge: DEGUCHI, Masaya