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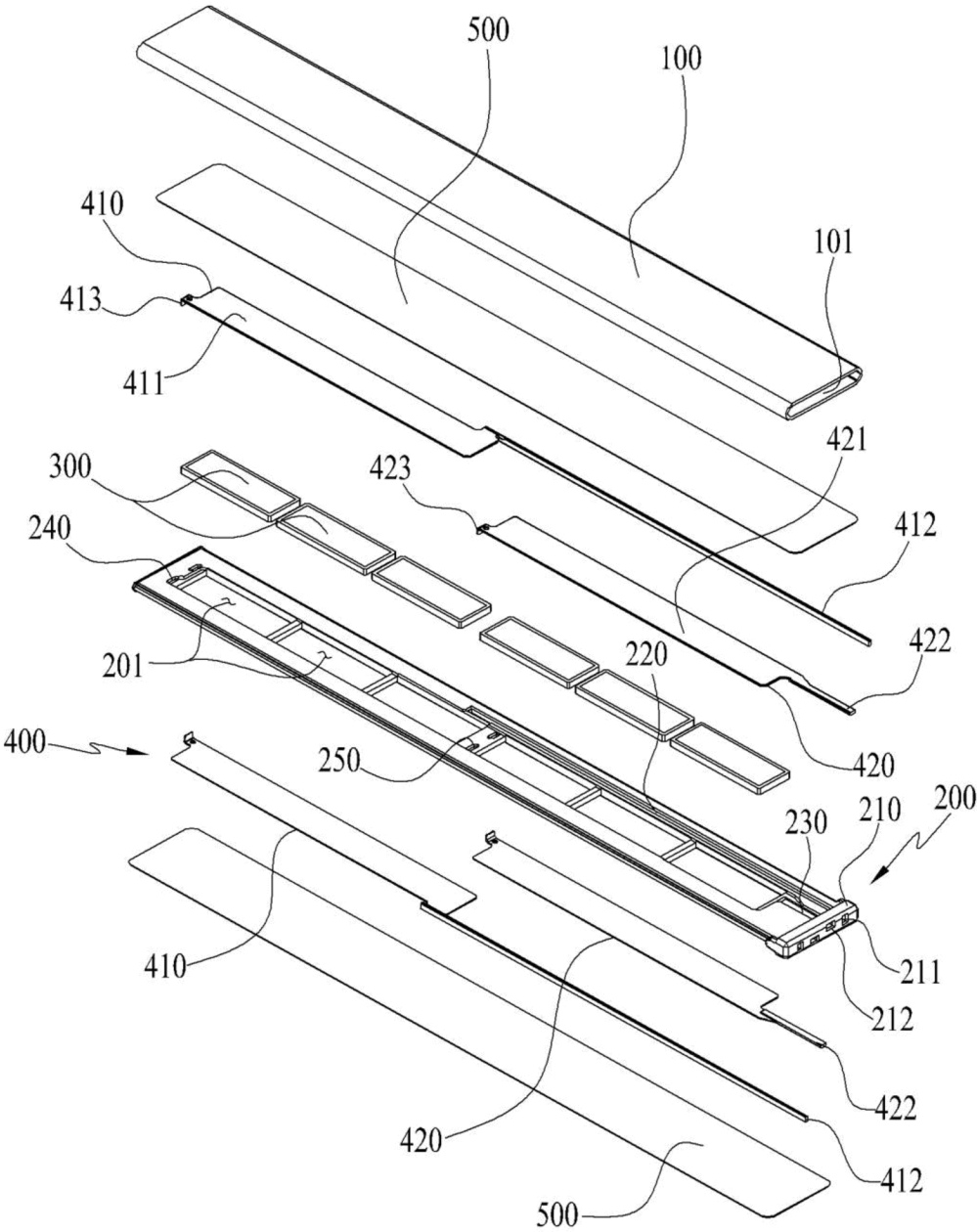
(54) **PTC HEATER ASSEMBLY**

(57) The present invention relates to a PTC heater assembly, comprising: a housing having a storage space formed therein; a PTC frame having a plurality of hollow holder portions formed at intervals along a longitudinal direction and having a terminal fastening portion at one end in the longitudinal direction; a plurality of PTC elements inserted into the holder portion of the PTC frame; a terminal plate extending along a longitudinal direction and making surface contact with one side and the other side of the PTC elements; and an insulating film attached to the outer surfaces of the terminal plate, wherein the

terminal plate is composed of a pair of first terminal plates facing each other that group and energize some of the plurality of PTC elements, and a pair of second terminal plates facing each other that are separated from the first terminal plate and energize the remainder of the PTC elements. Accordingly, even if either the first terminal plates or the second terminal plates generate heat due to energization, it is possible to prevent current from flowing into or heat from being conducted to the other, thereby enabling more accurate and precise temperature control and preventing unnecessary current from flowing.

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FIG. 4



Description

Technical Field

[0001] The present invention relates to a PTC heater assembly, and more specifically, to a PTC heater assembly capable of maximizing independent heating efficiency and significantly reducing an assembly defect rate by improving a configuration and coupling structure of a heater assembly.

Background Art

[0002] In general, a heating apparatus is installed in a vehicle for indoor heating, and dehumidification or defrosting of a front windshield of the vehicle.

[0003] Since such a heating apparatus is configured such that coolant flowing around an engine is introduced into a heater after the engine is started, a considerable amount of time is inevitably required for the coolant to be heated and for an interior of a vehicle to be warmed. Accordingly, there has been a disadvantage in that the interior of the vehicle remains in a cold state for a predetermined period of time after the engine is started.

[0004] Recently, electric vehicles have been increasingly developed. Since the electric vehicles do not include a separate engine and coolant system, electric heaters using electric resistance elements have been employed.

[0005] The electric heater uses a PTC heater assembly having PTC elements embedded therein.

[0006] Hereinafter, a PTC heater assembly according to the prior art will be described with reference to FIG. 1.

[0007] As illustrated, the PTC heater assembly according to the prior art includes positive (+) and negative (-) terminal plates 50 and 52, PTC elements 40 interposed therebetween, a PTC frame 30 accommodating the PTC elements 40, insulating films 20 attached to outer surfaces of the positive (+) and negative (-) terminal plates 50 and 52 and the PTC frame 30, and a housing 10 accommodating the PTC frame 30 to which the insulating films 20 are attached.

[0008] However, in the PTC heater assembly according to the prior art, when current is applied to the positive (+) and negative (-) terminal plates 50 and 52, all of the PTC elements 40 interposed therebetween generate heat simultaneously. Accordingly, there has been a disadvantage in that heating intensity adjustment, that is, temperature setting, is difficult to finely control and maintain.

[0009] Recently, to overcome the above-described disadvantages, as illustrated in FIG. 2, Korean Patent No. 1913121 (October 24, 2018) discloses an "independent-control PTC heater and apparatus" configured to independently control PTC elements so as to maximize energy efficiency and heating efficiency.

[0010] However, in the case of the "independent-control PTC heater and apparatus" according to the prior art,

a first opening 121-1 and a second opening 121-2 formed in a guide frame 120 into which PTC elements 110-1 and 110-2 are inserted are arranged to be offset from each other. Due to the structure in which the first opening 121-1 and the second opening 121-2 are offset from each other, the guide frame 120 must be formed to have a relatively large overall width. Accordingly, there is a disadvantage in that volume and weight increase, thereby increasing manufacturing costs.

[0011] Furthermore, since the common electrode plate 150 is configured to get in contact with respective one surfaces of both the PTC elements 110-1 and 110-2 inserted into the first opening 121-1 and the second opening 121-2, current is continuously supplied not only to one PTC element 110-1 but also even to the other PTC element 110-2 that does not require heat generation. Accordingly, the prior art eventually causes unnecessary current consumption, and heat generated from the heat-generating PTC element 110-1 affects the other PTC element 110-2 through the common electrode plate 150, thereby reducing independent heating efficiency.

Related Patents

[0012]

Patent 1: Korean Patent No. 1096286 (December 13, 2011)

Patent 2: Korean Patent No. 1913121 (October 24, 2018)

Disclosure

Technical Problem

[0013] Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the related art, and it is an objective of the present invention to provide a PTC heater assembly capable of maximizing independent heating efficiency and significantly reducing an assembly defect rate by improving a configuration and coupling structure of a heater assembly, thereby significantly improving reliability of product quality.

Technical Solution

[0014] To accomplish the above-mentioned objects, according to the present invention, there is provided a PTC heater assembly including: a housing having a storage space formed therein; a PTC frame accommodated in the storage space and having a plurality of hollow holder portions formed at intervals in a longitudinal direction and having a terminal fastening portion at one side end in the longitudinal direction; a plurality of PTC elements inserted into the holder portions of the PTC frame; terminal plates extending along the longitudinal direction while being in surface contact with one side surface and

the other side surface of each PTC element; and insulating films attached to outer surfaces of the terminal plates, wherein the terminal plates include a pair of first terminal plates facing each other and configured to group and energize some of the plurality of PTC elements, and a pair of second terminal plates separated from the first terminal plates, facing each other, and configured to energize remaining PTC elements.

[0015] Each of the first terminal plates includes: a first conductive plate facing and being in contact with the PTC elements; and a terminal portion extending from an outer side of one end of the first conductive plate toward the terminal fastening portion and coupled to the terminal fastening portion, and wherein each of the second terminal plates includes: a second conductive plate facing and being in contact with the PTC elements; and a terminal portion extending from an outer side of one end of the second conductive plate toward the terminal fastening portion and coupled to the terminal fastening portion.

[0016] when viewed in the longitudinal direction, the terminal portion of each of the first terminal plates is bent from an end of the first conductive plate toward the PTC elements so as to intersect one side surface of each PTC element.

[0017] The PTC frame is formed with a first fitting groove and a second fitting groove respectively accommodating and fittingly coupling the terminal portion of the first terminal plates and the terminal portion of the second terminal plates, and the first fitting groove is formed to have a greater depth than the second fitting groove.

[0018] Fastening bent portions are formed at end portions opposite to end portions on which the terminal portions are provided in the first terminal plates and the second terminal plates, respectively, wherein the PTC frame is formed with a third fastening hole and a fourth fastening hole to which the fastening bent portions of the first terminal plates and the second terminal plates are fastened.

[0019] Each terminal portion forms a double-structured overlapping portion by bending an end portion thereof.

Advantageous Effect

[0020] According to the present invention having the configuration as described above, by configuring a pair of first terminal plates and a pair of second terminal plates which independently group a plurality of PTC elements, even when either the first terminal plates or the second terminal plates generates heat due to energization, current flow or heat conduction to the other terminal plates may be prevented. Accordingly, temperature may be controlled more accurately and precisely, and unnecessary current flow may be blocked.

[0021] Additionally, the first terminal plates include terminal portions bent from ends of the first conductive plates toward the PTC elements to intersect one side surfaces of the PTC elements, and the PTC frame is

formed with first fitting grooves corresponding to the terminal portions to considerably increase a coefficient of friction by contacting both inner wall surfaces of the first fitting grooves, thereby maintaining a more rigid and stable coupling state and effectively suppressing an increase in overall width and weight of the PTC frame.

[0022] In addition, each terminal portion forms a double-structured overlapping portion to increase fastening rigidity due to increased thickness, reduce loosening of the terminal portions when assembled to the PTC frame, significantly improve current conduction efficiency, and enable stable current flow.

Description of Drawings

[0023]

FIG. 1 is an exploded perspective view illustrating a configuration of a PTC heater assembly according to a prior art.

FIG. 2 is an exploded perspective view illustrating a configuration of a PTC heater assembly according to another prior art.

FIG. 3 is a perspective view illustrating a PTC heater assembly according to an embodiment of the present invention.

FIG. 4 is an exploded perspective view of FIG. 3.

FIG. 5 is a side cross-sectional view of FIG. 3.

FIG. 6 is an enlarged view illustrating a configuration of a terminal plate of FIG. 4.

FIG. 7 is a plan view illustrating a PTC frame of FIG. 4.

FIG. 8 is a side view in a longitudinal direction illustrating another example of an overlapping portion formed on the terminal plate of FIG. 4.

Mode for Invention

[0024] Hereinafter, preferred embodiments of a PTC heater assembly according to the present invention will be described in detail with reference to the accompanying drawings.

[0025] For reference, terms and words used in the present specification and claims should not be interpreted as being limited to ordinary or dictionary meanings, and should be interpreted as meanings and concepts consistent with the technical spirit of the present invention based on the principle that the inventor may appropriately define the terms in order to describe the invention in the best manner.

[0026] Moreover, embodiments described in the present specification and configurations illustrated in the drawings are merely preferred embodiments of the present invention and do not represent all technical features of the present invention. Therefore, it should be understood that various equivalents and modifications capable of replacing the embodiments and configurations may exist at the time of filing of the present application and

thereafter.

[0027] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to FIGS. 3 to 8.

[0028] As illustrated, the PTC heater assembly according to the present invention includes a housing 100 having a storage space 101 formed therein, a PTC frame 200 accommodated in the storage space 101 and having a plurality of hollow holder portions 201 formed at intervals in a longitudinal direction and a terminal fastening portion 210 at one end thereof in the longitudinal direction, a plurality of PTC elements 300 inserted into the holder portions 201 of the PTC frame 200, terminal plates 400 making surface contact with opposite side surfaces of the PTC elements 300 and extending in the longitudinal direction, and insulating films 500 attached to outer surfaces of the terminal plates 400.

[0029] In particular, the terminal plates 400 include a pair of first terminal plates 410 facing each other and configured to group and energize some of the plurality of PTC elements 300, and a pair of second terminal plates 420 separated from the first terminal plates 410, facing each other, and configured to energize the remaining PTC elements 300.

[0030] In this case, each of the first terminal plates 410 includes a first conductive plate 411 facing and contacting the PTC elements 300, and a terminal portion 412, which has a narrower width than the first conductive plate 411, extending from an outer side of one end of the first conductive plate 411 toward the terminal fastening portion 210 and coupled to the terminal fastening portion 210.

[0031] Each of the second terminal plates 420 includes a second conductive plate 421 facing and contacting the PTC elements 300, and a terminal portion 422, which has a narrower width than the second conductive plate 421, protruding from an outer side of one end of the second conductive plate 421, wherein an end portion of the terminal portion 422 extends in a direction passing through the terminal fastening portion 210.

[0032] The housing 100 is an exterior member extending in a predetermined length and having the storage space 101 formed therein, and serves to safely protect the PTC frame 200, the PTC elements 300, the terminal plates 400, and the insulating films 500, and to simultaneously prevent moisture or foreign substances from penetrating from the outside.

[0033] Here, the housing 100 is preferably made of a metal material such as aluminum having excellent heat transfer efficiency.

[0034] The terminal plates 400 respectively making surface contact with one side surfaces and the other side surfaces of the PTC elements 300 are disposed to have opposite polarities (positive and negative).

[0035] The PTC frame 200 extends in the longitudinal direction, and a plurality of hollow holder portions 201 into which the plurality of PTC elements 300 are inserted are formed in the longitudinal direction.

[0036] That is, by the holder portions 201, the PTC elements 300 may stably perform a heat generation operation by energization without shaking.

[0037] The PTC frame 200 is preferably made of a synthetic resin material so as to maintain an insulated state in which the terminal plates 400 disposed on opposite sides with the plurality of PTC elements 300 interposed therebetween are not in contact with each other.

[0038] Additionally, at one end of the PTC frame 200 in the longitudinal direction, a terminal fastening portion 210 is provided in which a pair of first fastening holes 211 and a pair of second fastening holes 212 are respectively formed such that end portions of the terminal portions 412 of the first terminal plates 410 and the terminal portions 422 of the second terminal plates 420 are inserted there-through.

[0039] The PTC frame 200 according to the present invention is formed with a first fitting groove 220 and a second fitting groove 230 into which the terminal portion 412 of the first terminal plates 410 and the terminal portion 422 of the second terminal plates 420 are respectively fittingly coupled.

[0040] Here, when viewed in a plan view, the first fitting groove 220 and the second fitting groove 230 are formed to have different widths, wherein the first fitting groove 220 has a narrower width than the second fitting groove 230, and the first fitting groove 220 is formed to have a greater depth than the second fitting groove 230.

[0041] This is because, when viewed in the longitudinal direction, the terminal portion 412 constituting each of the first terminal plates 410 is bent toward the PTC elements 300 so as to intersect one side surfaces of the PTC elements 300, thereby making it possible for the terminal portion 412 to be formed to have a narrower width and a greater height than the terminal portion 422 of each of the second terminal plates 420.

[0042] That is, the terminal portion 412 of each of the first terminal plates 410 fitted into the first fitting groove 220 is formed in an upright state, and the first fitting groove 220 vertically accommodates the terminal portion 412, thereby making it possible to more stably fix the terminal portion 412.

[0043] Moreover, when viewed in a plan view, both side surfaces of the terminal portion 412 of each of the first terminal plates 410 are in contact with entire inner wall surfaces on both sides of the first fitting groove 220, thereby greatly increasing a coefficient of friction. Accordingly, even when the PTC frame 200 is turned over, erected, or shaken in a lifted state in order to temporarily assemble the PTC heater assembly, the first terminal plates 410 having the terminal portion 412 are not separated and may stably maintain the firmly fixed state.

[0044] Furthermore, due to such a structural characteristic, the first fitting groove 220 greatly reduces a width of a space for accommodating the terminal portion 412, thereby minimizing the overall width of the PTC frame 200 and effectively minimizing an increase in overall volume.

[0045] Accordingly, it is preferable that widths and heights of the first fastening hole 211 and the second fastening hole 212 into which end portions of the terminal portion 412 of each of the first terminal plates 410 and the terminal portion 422 of each of the second terminal plates 420 are fitted are formed differently from each other.

[0046] As illustrated, the first fastening hole 211 is configured to have a narrower width and a greater height than the second fastening hole 212.

[0047] In addition, the PTC frame 200 is formed with a third fastening hole 240 and a fourth fastening hole 250 configured to fasten the first terminal plates 410 and the second terminal plates 420 of the terminal plates 400 at positions different from the terminal fastening portion 210.

[0048] That is, the third fastening hole 240 and the fourth fastening hole 250 are hollow holes configured such that additional fastening may be performed at opposite end portions of the terminal portions 412 and 422 of the first terminal plates 410 and the second terminal plates 420.

[0049] As described above, when viewed in the longitudinal direction, the terminal portion 412 of each of the first terminal plates 410 is preferably bent from an end of the first conductive plate 411 toward the PTC elements 300 so as to intersect one side surfaces of the PTC elements 300.

[0050] Specifically, the terminal portion 412 preferably has the same thickness as the first conductive plate 411 and is formed to have a relatively narrower width than the first conductive plate 411, and extends toward the terminal fastening portion 210, wherein the terminal portion 412 is bent at a 90° angle with respect to the first conductive plate 411 so that its edge portion faces the PTC element 300.

[0051] Meanwhile, the PTC elements 300 are a plurality of components inserted into the holder portions 201 of the PTC frame 200, and may be manufactured in a quadrangular plate-shape.

[0052] However, the shape of the PTC element is not particularly limited.

[0053] The PTC elements 300 inserted into the holder portions 201 of the PTC frame 200 generate heat by current applied through being in contact with the pair of first terminal plates 410 and the pair of second terminal plates 420 on one side surfaces and the other side surfaces thereof, respectively.

[0054] The first terminal plates 410 and the second terminal plates 420 divide the PTC elements 300 into two groups in the longitudinal direction and independently supply current to the respective groups. Accordingly, even when either the first terminal plates 410 or the second terminal plates 420 generates heat due to energization, it is possible to prevent current from being unintentionally supplied to or heat from being conducted to the other. Therefore, temperature may be controlled more accurately and precisely, and unnecessary current flow may be blocked.

[0055] The first terminal plates 410 and the second terminal plates 420 are respectively formed with fastening bent portions 413 and 423 fastened to the third fastening hole 240 and the fourth fastening hole 250 respectively at end portions opposite to end portions on which the terminal portions 412 and 422 are provided.

[0056] In addition, each of the terminal portions 412 and 422 is bent to form double-structured overlapping portions 412a and 422a in order to increase fastening rigidity.

[0057] That is, by forming the double-structured overlapping portions 412a and 422a, thickness thereof is doubled, thereby increasing fastening strength, reducing loosening during assembly of the PTC frame, significantly improving current conduction efficiency, and enabling stable current flow.

[0058] That is, as illustrated in FIG. 8, the overlapping portion 412a of the terminal portion may be bent in a "V"-shape so as to be elastically seated on or coupled to an inner wall surface of the first fitting groove 220.

[0059] The overlapping portions 412a and 422a having the double structure may also be formed by additionally attaching separate terminal plates corresponding to the respective terminal portions 412 and 422 through welding.

[0060] Meanwhile, the insulating films 500 are respectively attached to upper and lower outer surfaces of the first terminal plates 410 and the second terminal plates 420, and perform an insulating function of preventing current flowing through the first terminal plates 410 and the second terminal plates 420 from being conducted to the housing 100.

[0061] It is preferable to additionally apply or attach a synthetic resin material having elasticity to upper portions of the insulating films 500. This is intended to maximize internal residual stress when the housing 100 is compressed.

[0062] Here, the insulating films 500 are preferably configured by combining an insulator having excellent insulation properties and heat dissipation properties with a synthetic resin material having elasticity. However, the present invention is not necessarily limited thereto, and various excellent materials capable of maximizing insulation properties, adhesion properties, and internal residual stress when the housing 100 is compressed may be applied.

[0063] Although the present invention has been described above with reference to the above-described embodiments and the accompanying drawings, the present invention is not limited thereto, and it will be apparent to those skilled in the art to which the present invention pertains that various substitutions, modifications, and changes may be made without departing from the technical spirit of the present invention.

Claims

1. A PTC heater assembly comprising:

a housing having a storage space formed there- 5
in;
a PTC frame accommodated in the storage
space and having a plurality of hollow holder
portions formed at intervals in a longitudinal
direction and having a terminal fastening portion 10
at one side end in the longitudinal direction;
a plurality of PTC elements inserted into the
holder portions of the PTC frame;
terminal plates extending along the longitudinal
direction while being in surface contact with one 15
side surface and the other side surface of each
PTC element; and
insulating films attached to outer surfaces of the
terminal plates,
wherein the terminal plates include a pair of first
terminal plates facing each other and configured
to group and energize some of the plurality of
PTC elements, and a pair of second terminal
plates separated from the first terminal plates,
facing each other, and configured to energize 25
remaining PTC elements.

2. The PTC heater assembly according to claim 1, wherein each of the first terminal plates includes:

a first conductive plate facing and being in con- 30
tact with the PTC elements; and
a terminal portion, which has a narrower width
than the first conductive plate, extending from an
outer side of one end of the first conductive plate 35
toward the terminal fastening portion and
coupled to the terminal fastening portion,
and wherein each of the second terminal plates
includes:

a second conductive plate facing and being 40
in contact with the PTC elements; and
a terminal portion, which has a narrower
width than the second conductive plate,
extending from an outer side of one end 45
of the second conductive plate toward the
terminal fastening portion and coupled to
the terminal fastening portion.

3. The PTC heater assembly according to claim 2, 50 wherein the terminal portion of each of the first terminal plates is bent from an end of the first con- ductive plate toward the PTC elements so as to intersect one side surface of each PTC element.

4. The PTC heater assembly according to claim 3, 55 wherein the PTC frame is formed with a first fitting groove and a second fitting groove respectively ac-

commodating and fittingly coupling the terminal por-
tion of the first terminal plates and the terminal por-
tion of the second terminal plates, and
wherein the first fitting groove is formed to have a
greater depth than the second fitting groove.

5. The PTC heater assembly according to any one of claims 2 to 4, wherein fastening bent portions are formed at end portions opposite to end portions on which the terminal portions are provided in the first terminal plates and the second terminal plates, re- spectively, and wherein the PTC frame is formed with a third fasten- ing hole and a fourth fastening hole to which the fastening bent portions of the first terminal plates and the second terminal plates are fastened.

6. The PTC heater assembly according to claim 4, wherein each terminal portion forms a double-struc- tured overlapping portion by bending an end portion thereof.

FIG.1

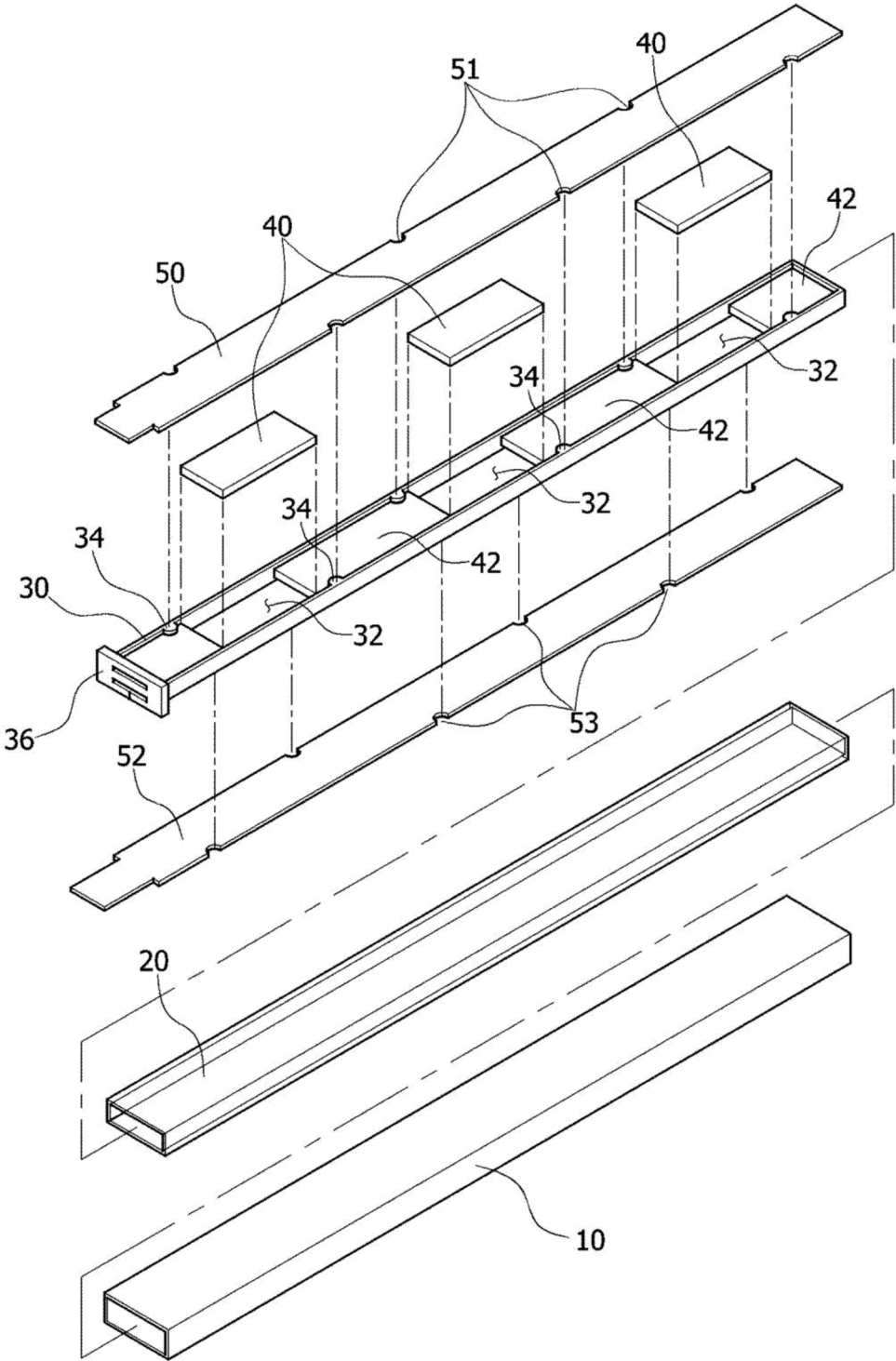


FIG.2

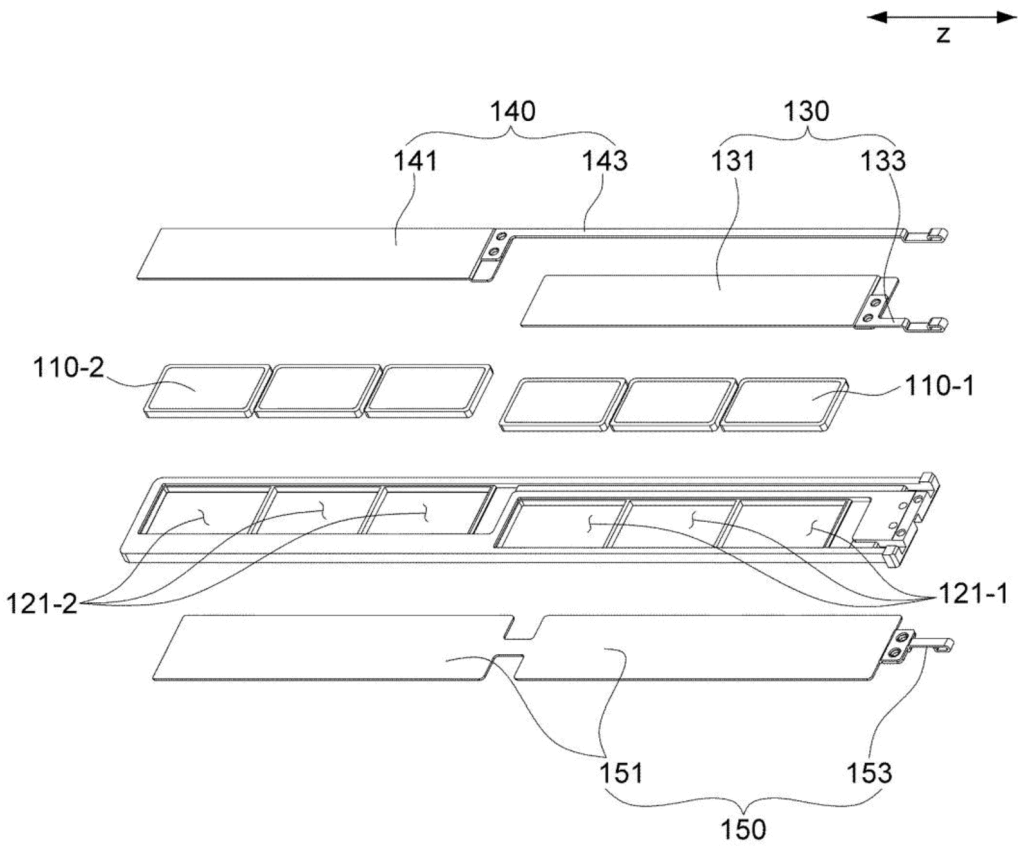


FIG. 3

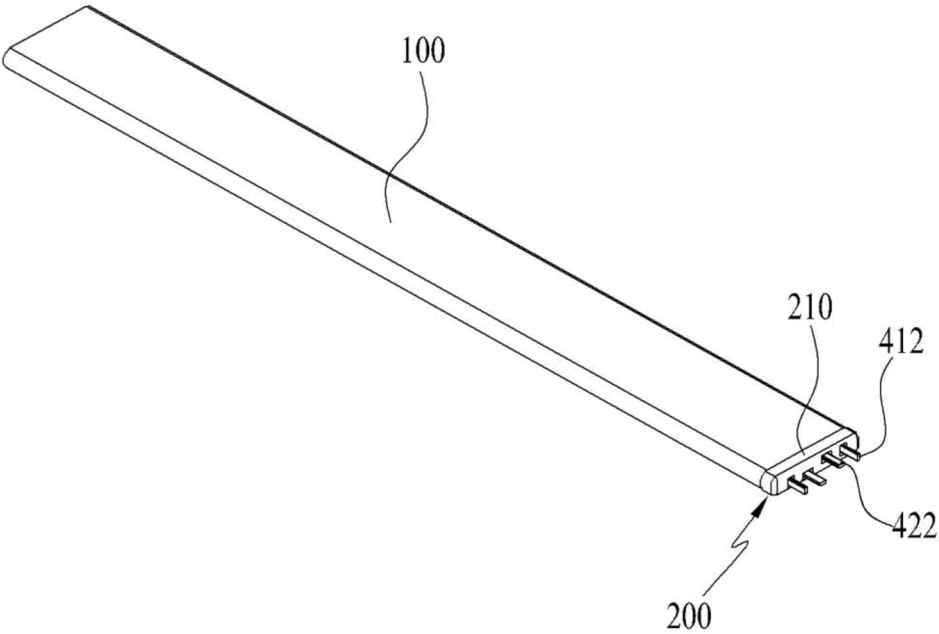


FIG. 4

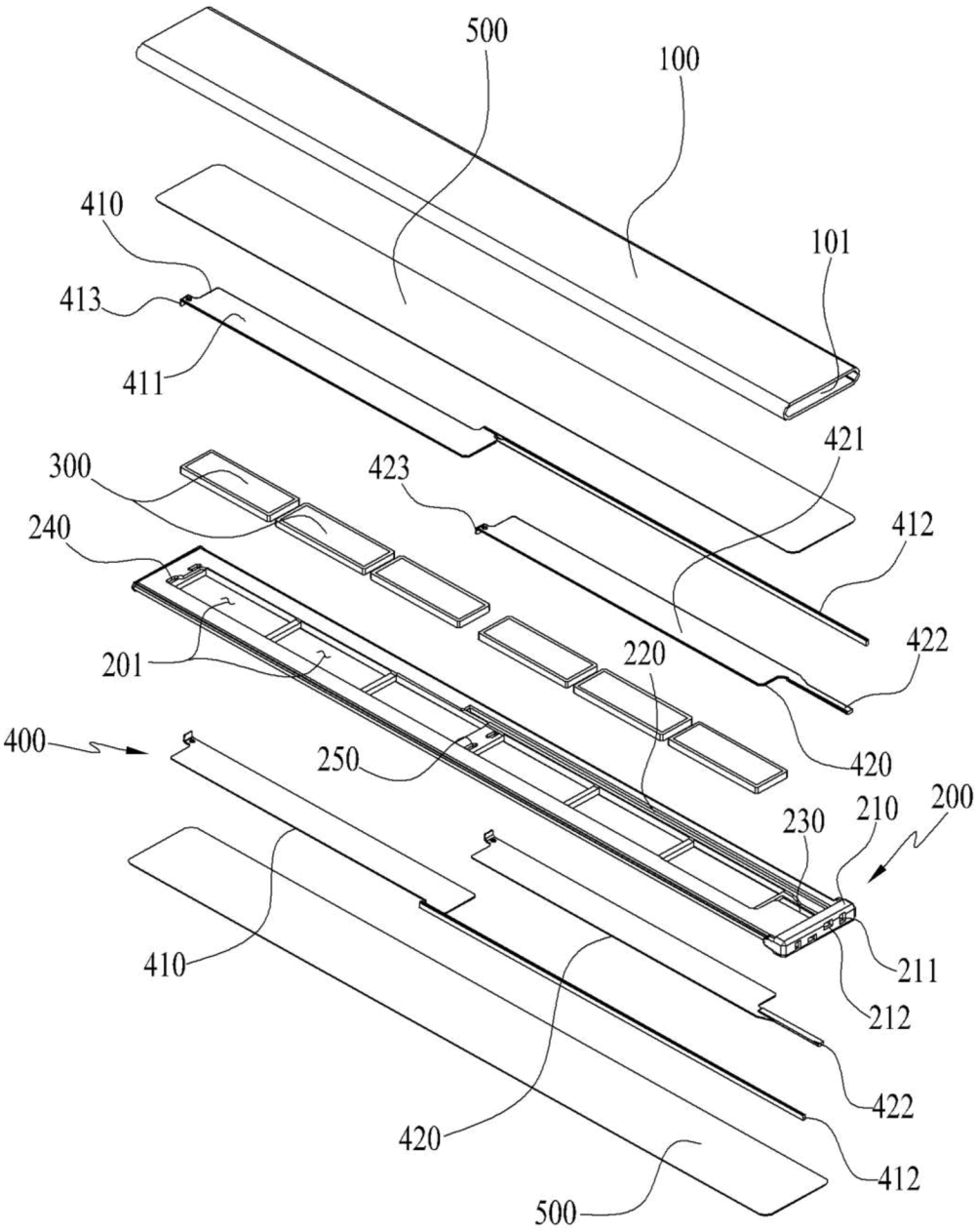


FIG. 5

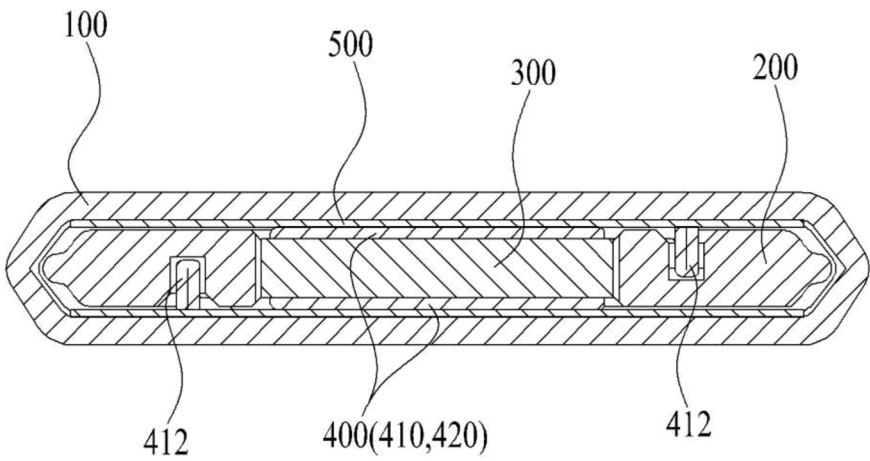


FIG.6

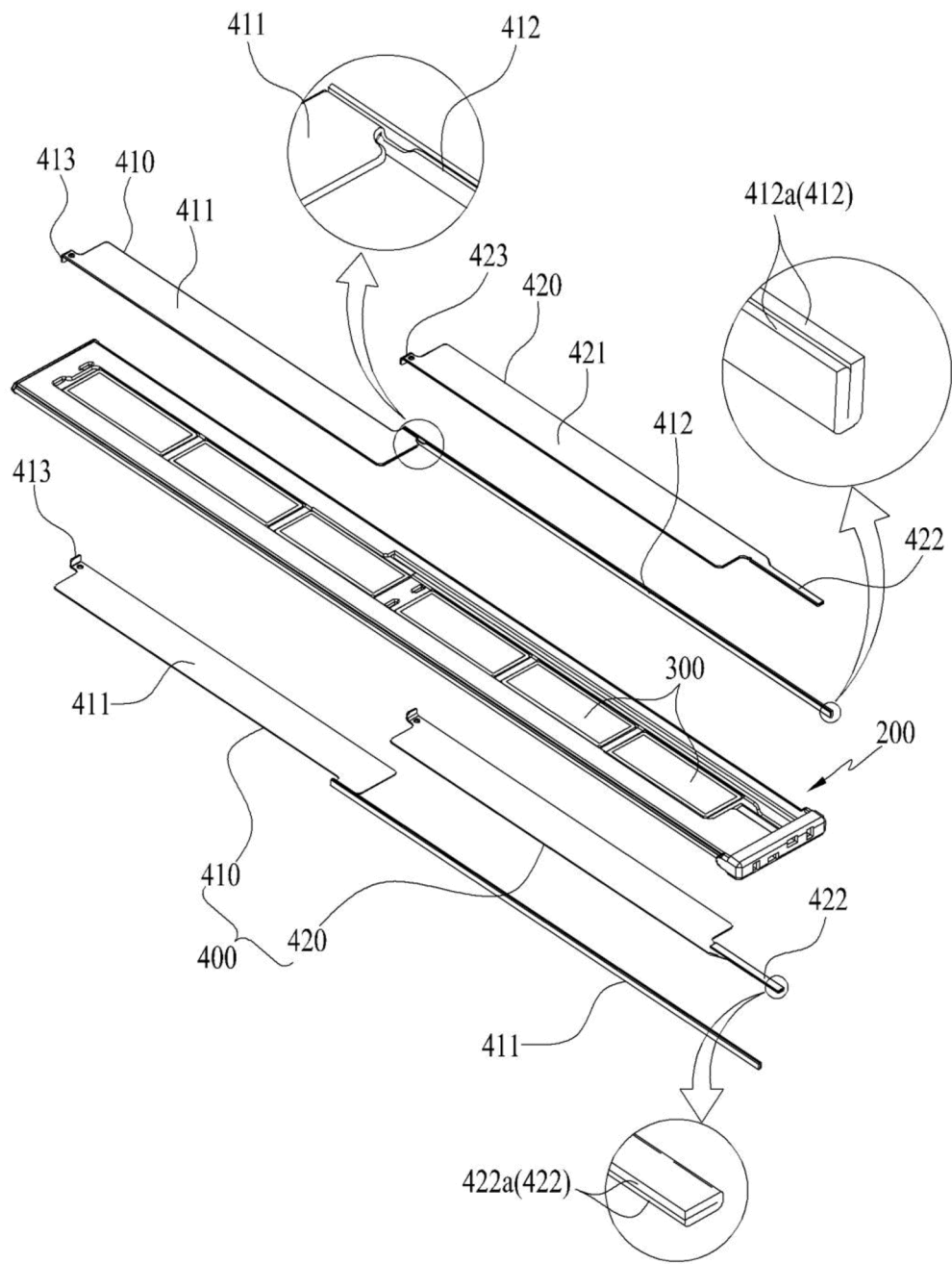


FIG. 7

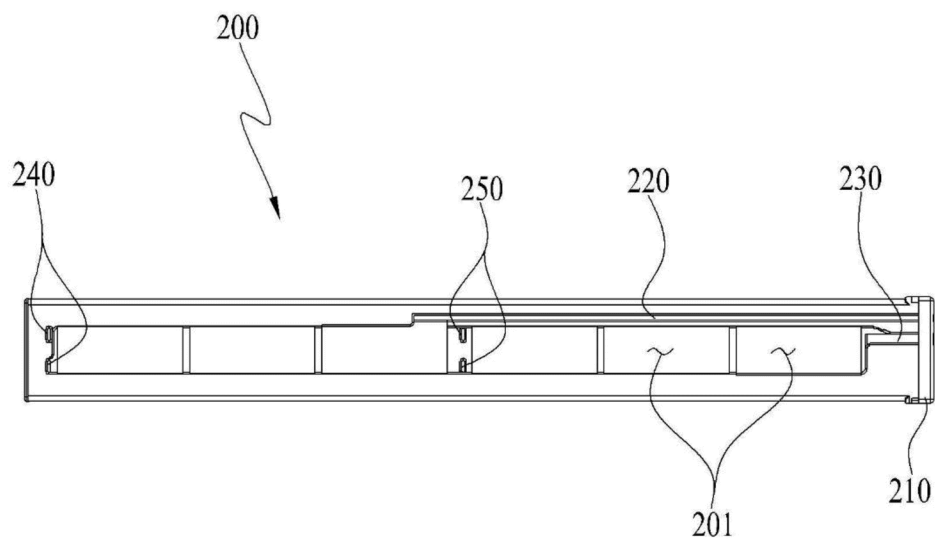
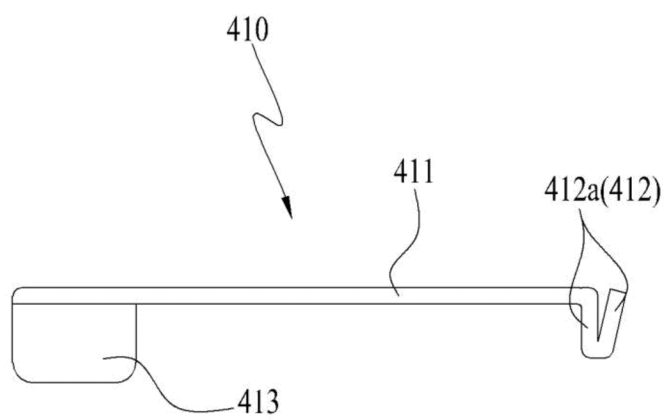


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/010019

A. CLASSIFICATION OF SUBJECT MATTER**H05B 3/06**(2006.01)i; **H05B 3/00**(2006.01)i; **H05B 1/02**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H05B 3/06(2006.01); B60H 1/00(2006.01); B60H 1/02(2006.01); B60H 1/22(2006.01); F24H 9/1863(2022.01);
H05B 1/02(2006.01); H05B 3/02(2006.01); H05B 3/03(2006.01); H05B 3/12(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: housing, opening, PTC heater, PTC element, terminal plate, grouping, pair

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
DY	KR 10-1913121 B1 (JAHWA ELECTRONICS CO., LTD. et al.) 31 October 2018 (2018-10-31) See paragraphs [0037]-[0092]; claim 1; and figures 1-6.	1-6
Y	KR 10-2023-0039152 A (JAHWA ELECTRONICS CO., LTD.) 21 March 2023 (2023-03-21) See paragraphs [0064]-[0066]; and figure 3.	1-6
Y	KR 10-2022-0100145 A (WOORY INDUSTRIAL COMPANY, LTD.) 15 July 2022 (2022-07-15) See paragraph [0060]; and figure 3.	5
A	KR 10-2022-0110711 A (JAHWA ELECTRONICS CO., LTD.) 09 August 2022 (2022-08-09) See paragraphs [0026]-[0072]; and figures 1-5.	1-6
A	CN 216852387 U (DONGGUAN SIER LU ELECTRONIC CO., LTD.) 28 June 2022 (2022-06-28) See claims 1-10 and figures 1-2.	1-6

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

22 October 2024

Date of mailing of the international search report

22 October 2024

Name and mailing address of the ISA/KR

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Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/010019

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/010019

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				CN	206365062	U		28 July 2017
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				EP	3694293	A1		12 August 2020
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