Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2871573 A1 2013/10/31

(21) 2 871 573

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2013/04/24
(87) Date publication PCT/PCT Publication Date: 2013/10/31
(85) Entrée phase nationale/National Entry: 2014/10/24
(86) N° demande PCT/PCT Application No.: IT 2013/000121
(87) N° publication PCT/PCT Publication No.: 2013/160925
(30) Priorité/Priority: 2012/04/26 (ITN.NA 2012 A 000019)

(51) Cl.Int./Int.Cl. *H02S 40/44* (2014.01), *H01L 33/16* (2010.01), *H02S 20/32* (2014.01), *H02S 40/32* (2014.01)

(71) Demandeurs/Applicants:
WITS ENGINEERING S.R.L., IT;
TIANO, FRANCESCO ANTONIO, IT;
TIANO, LUCA, IT

(72) Inventeurs/Inventors:
TIANO, FRANCESCO ANTONIO, IT;
TIANO, LUCA, IT;
TIANO, ANTONIO, IT;
BUKSHTYNAVA, AKSANA, IT

(74) Agent: BORDEN LADNER GERVAIS LLP

(54) Titre : GENERATEUR SOLAIRE HYBRIDE
(54) Title: HYBRID SOLAR GENERATOR

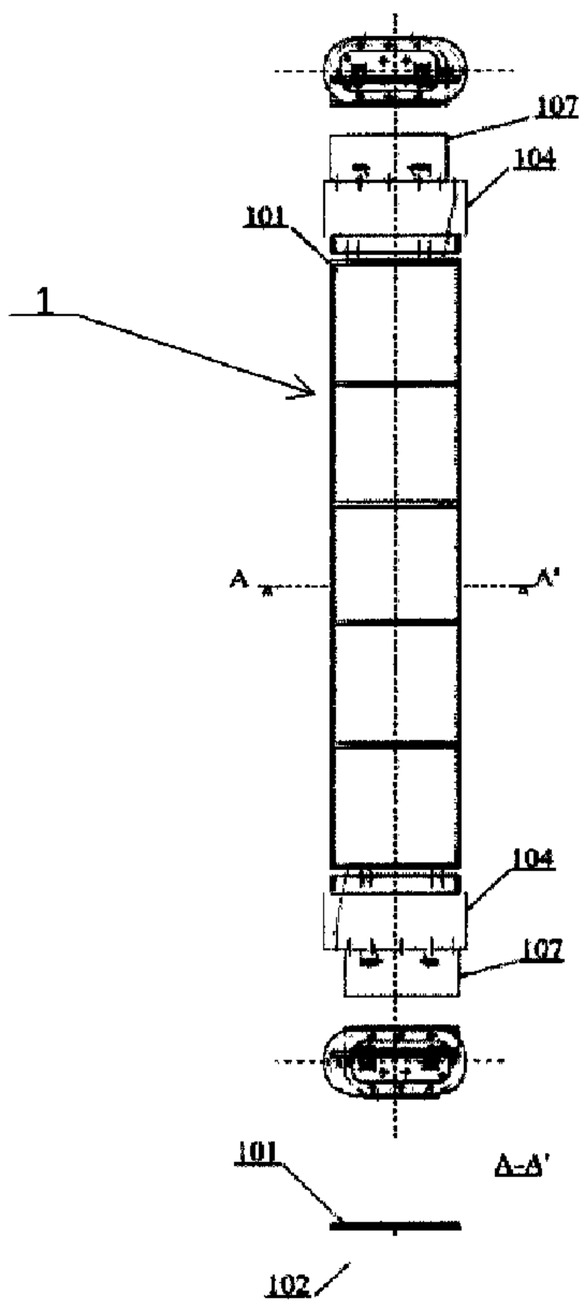


FIG. 1

(57) Abrégé/Abstract:
An hybrid solar generator (1) is described, comprising at least one photo-voltaic module (100; 101) contained inside at least one containing means (102) which is at least partially transparent, such module (100; 101) being immersed at least partially into at least one dielectric fluid contained inside such containing means (102).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 October 2013 (31.10.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/160925 A3

(51) International Patent Classification:
H01L 31/058 (2006.01)

(21) International Application Number:
PCT/IT2013/000121

(22) International Filing Date:
24 April 2013 (24.04.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
N.NA 2012 A 000019
26 April 2012 (26.04.2012) IT

(72) Inventor; and
(71) Applicant : **TIANO, Francesco Antonio** [IT/IT]; Via Corallo 122, I-84016 Pagani (SA) (IT).

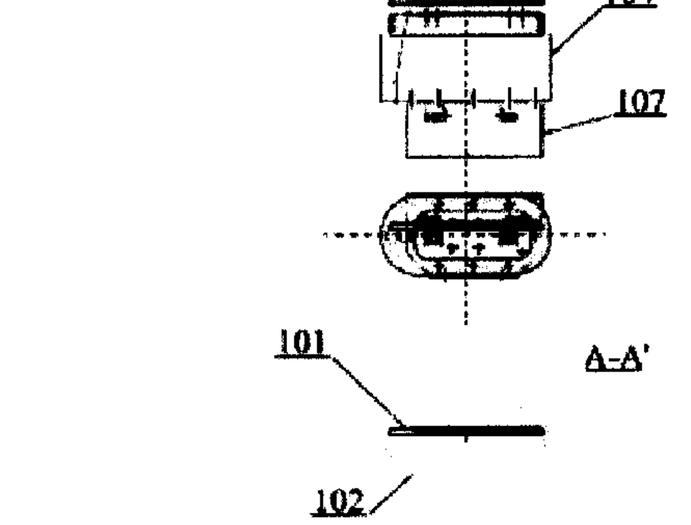
(72) Inventors: **TIANO, Antonio**; VIA TRENTO 74/E, 1-84016 PAGANI (SA) (IT). **TIANO, Luca**; Via Corallo 122, I-84016 Pagani (SA) (IT). **BUKSHTYNAVA, Aksana**; VIA TRENTO 74/E, 1-84016 PAGANI (SA) (IT).

(74) Agent: **GARAVELLI, Paolo**; A.BRE.MAR. S.R.L., VIA SERVAIS 27, I-10146 TORINO (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

[Continued on next page]

(54) Title: HYBRID SOLAR GENERATOR



(57) Abstract: An hybrid solar generator (1) is described, comprising at least one photo-voltaic module (100; 101) contained inside at least one containing means (102) which is at least partially transparent, such module (100; 101) being immersed at least partially into at least one dielectric fluid contained inside such containing means (102).

WO 2013/160925 A3

WO 2013/160925 A3

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
12 September 2014

HYBRID SOLAR GENERATOR

The present invention refers to an hybrid solar generator for producing electric and thermal energy.

Photo-voltaic modules are known in the art, composed of photo-voltaic cells, assembled in hybrid solar panels, typically used as generators of electric and thermal energy in a photo-voltaic plant.

Known photo-voltaic modules and related hybrid solar panels are equipped with an indirect cooling system to reduce the temperature of the photo-voltaic modules, increased by the radiating solar energy. Cooling of such known elements is usually provided by a thermal solar manifold placed on the rear surface of an hybrid solar panel, that operates as heat exchanger, characterised by an aluminium plate shaped as a serpentine circuit, in which a dielectric fluid circulates, which contributes to lower the operating temperature of the photo-voltaic panel; moreover, to avoid

possible over-pressure phenomena due to the lack of capability of compressing the circulating fluid, the serpentine circuit ducts have different diameters at the entry and exit thereof. The known heat exchanger is adherent to the rear surface of the hybrid solar panel, implying a thermal dilatation of the exchanger which is greater than the maximum thermal dilatation of the solar panel or vice versa, generating a potential mechanical failure of one of the two components: an example of such system is disclosed, in particular, in WO2008/143482A2.

Currently, hybrid solar panels used as generators of current electric energy do not guarantee a continuous delivery of electric energy, being the operation of the photo-voltaic cells and consequently of the photo-voltaic modules subjected to the presence of sun-light.

Hybrid solar panels inserted in more complex photo-voltaic systems are also known, but they are constrained to the shape of the surface on which they are installed, consequently limiting the installation direction of the solar panels.

Anti-theft protection systems are also known for photo-voltaic modules, inserted in the related

photo-voltaic plant, but not integrated in the single photo-voltaic module; they further have big sizes, whose installation requires specialised personnel: an example of such system is disclosed, in particular, in WO2011/151672A1.

Finally, known photo-voltaic modules have on their surface a protecting layer made of Ethylen Vinyl Acetate (EVA): such surface protecting system implies an increase of manufacturing costs for the modules and a difficult procedure for disposing of and recovering used materials.

Therefore, object of the present invention is solving the above prior art problems, by providing an hybrid solar generator which maximises the generation of electric and thermal energy.

A further object of the present invention is providing an hybrid solar generator adapted to use every type of existing photo-voltaic modules, in particular equipped with a protecting layer made of Ethylen Vinyl Acetate (EVA).

The above and other objects and advantages of the present invention, as will appear from the following description, are obtained with an hybrid solar generator like the one disclosed in the independent claim. Preferred embodiments and non-

trivial variations of the present invention are the subject matter of the dependent claims.

It is clear that all enclosed claims are an integral part of the present description.

The present invention will be better described by some preferred embodiments thereof, provided as a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 is a side and sectional view of a preferred embodiment of the hybrid solar generator according to the present invention;
- Figures 2, 3, 4, 6, 7, 8, 10 show side views of the main components of the hybrid solar generator according to the present invention;
- Figure 11 shows a side view of a solar following system of the hybrid solar generator according to the present invention;
- Figure 12 shows a side and sectional view of a second preferred embodiment of the hybrid solar generator according to the present invention;
- Figure 13 shows a side and sectional view of a third preferred embodiment of the hybrid solar generator according to the present invention;
- Figure 14 shows a side view of a component of

the third preferred embodiment of the hybrid solar generator according to the present invention;

- Figure 15 shows a side and sectional view of a fourth preferred embodiment of the hybrid solar generator according to the present invention;

- Figures 5, 9, 16 show side views of the components of a fourth preferred embodiment of the hybrid solar generator according to the present invention;

- Figure 17 shows a side and sectional view of a fifth preferred embodiment of the hybrid solar generator according to the present invention;

- Figure 18 shows a side view of a component of the fifth preferred embodiment of the hybrid solar generator according to the present invention;

- Figures 19 to 29 show side and sectional views of ten different preferred embodiments of the hybrid solar generator according to the present invention.

With reference to the Figures, a preferred embodiment of the present invention is shown and described. It will be immediately obvious that numerous variations and modifications (for example related to shape, sizes, arrangements and parts

with equivalent functionality) could be made to what is described, without departing from the scope of the invention, as appears from the enclosed claims.

With reference to the Figures, the hybrid solar generator 1 according to the present invention comprises at least one photo-voltaic module 100 without any protecting layer, for example made of Ethylen Vinyl Acetate (EVA), and/or at least one photo-voltaic module 101 covered by at least one protecting surface layer 13, such layer 13 being preferably made of Ethylen Vinyl Acetate (EVA); both such modules 100 and 101 can be composed of photo-voltaic cells 10 made of amorphous crystalline, poly-crystalline silicon or other suitable material, arranged on the upper supporting surface 11 of the modules 100, 101 and mutually connected through suitably wired electric terminals 12.

The photo-voltaic module 100 and/or 101 is inserted inside at least one containing means 102, such containing means 102 being preferably of a cylindrical shape and such photo-voltaic module 100 and/or 101 being arranged along the internal median line of such cylindrical containing means 102, this

latter one obviously having suitable section, length, thickness and curvature, such containing means 102 being made at least partially with at least one transparent or plastic material or other suitable material to allow the passage of sun radiations towards such photo-voltaic module 100 and/or 101: advantageously, at least such photo-voltaic module 100 and/or 101 is immersed at least partially into at least one dielectric fluid, such as a refrigerating dielectric fluid in liquid or gaseous form, or a mixture of dielectric refrigerating fluids in liquid or gaseous form, or other suitable medium contained inside such containing means 102.

The containing means 102 comprise two closing means 104, such as plugs, an upper one and a lower one, or other suitable means, and at least two covering and fastening means 107, such as covers or other suitable means for making an airtight sealing of the containing means 102.

The closing means 104 comprise:

- at least one room 14 suitable to house at least one electronic control card, and possibly other electric components such as cables, connectors or other ones suitable for the electric

wiring;

- one or more holes 15 suitable for the passage of electric connections between such transparent containing means 102 and at least one electronic board;

- at least one hole 17 suitable for the passage of such dielectric fluid inside such transparent containing means 102;

- at least two sealing gaskets 21;

- at least one duct 20, such as preferably a hole, a microphone or a micro-channel, suitable for the injection of sealing resins inside such closing means 104 next to such sealing gaskets 21; electric wirings, electronic boards and connectors are installed in the room 14 of the closing means 104 and 103. Once having completed the installation of the above components, the sealing and filling resin is poured inside the room 14, in the interspaces between the room 14 walls and the electronic boards, to protect the circuits from humidity and water, and to insulate the interior of the transparent pipe 102 from outside, since the sealing and filling resin also closes the holes 15. The dielectric fluid cannot go out of the room 14,

but only of the hole 17. The above process for annealing the electronic circuits with resins is also defined as heating of electronic boards with resins or paints. As regards the improvement of airtightness globally, the two sealing gaskets 21, even if made of a suitable material, could yield or collapse after a certain time: to improve their performance through the duct 20, sealing and filling resin is injected next to the two sealing gaskets 21, and in this case it is not heating, but only resin coating;

- at least one hole 22 for placing at least one thermal probe inside such transparent containing means 102;
- at least one threaded hole 32 adapted to fasten such covering and fastening means 107 onto such closing means 104, such duct 20 being preferably obtained inside at least one of such threaded holes 32.

The covering and fastening means 107 are advantageously suitable also for the fastening of the hybrid solar generator 1 according to the present invention to a supporting structure, and for such purpose they comprise:

- a lever-type system 108, associated with such covering and fastening means 107 through at least one fastening hole 27;
- at least one direct current (DC) electric connector 23 connected to an electric terminal 12 of such photo-voltaic module 100 and/or 101, allowing to withdraw the electric energy produced by such module 100 and/or 101;
- at least one alternate current (AC) electric connector 24;
- at least one fastening hole 26 adapted to fasten such covering and fastening means 107 to such closing means 104 through at least one of such threaded holes 32;
- at least one fastening hole 28 suitable to guarantee at least one fixed positioning of such hybrid solar generator 1 according to the present invention.

The lever-type system 108, comprising at least one fulcrum 30 and at least one hole 29, allows rotating the hybrid solar generator 1 according to the present invention along its own axis, enabling the solar following 200 of the hybrid solar generator 1 according to the present invention,

guaranteeing operating conditions with maximum efficiency for the photo-voltaic module 100 and/or 101.

The thermal probe placed inside the containing means 102 is suitable to detect a temperature value of the dielectric fluid present inside the containing means 102, and to send a signal through the connector 23 placed on the covering and fastening means 107 to at least one remote controller. This latter one, when the signal received from the thermal probe exceeds the preset activation temperature value, generates a direct cooling of the module 100 and/or 101, inducing therein a forced circulation of the dielectric fluid inside the containing means 102. Moreover, the remote controller can activate the direct cooling also without the signal coming from the thermal probe, comparing at least one value of the external temperature of the environment in which the hybrid solar generator 1 according to the present invention is placed, measured by at least one external thermal probe and at least one electric power value generated by the photo-voltaic module 100 and/or 101.

The hybrid solar generator 1, as shown in

Figure 12, has a second preferred embodiment, comprising:

- a different wiring of the electric terminals 12 of the photo-voltaic module 100 and/or 101;
- at least one GPS locating device 110, supplied by activating the production process of electric energy, suitable to protect the module 100 and/or 101 against a possible theft, comparing the geographic coordinates of the detected position with those previously loaded in the locating device, such GPS locating device 110 being equipped with at least one power circuit suitable to enable and/or disable the supply of electric energy, produced by such photo-voltaic module 100 and/or 101, following the result obtained by comparing the coordinates.

The hybrid solar generator 1, as shown in Figure 13, 14, has a third preferred embodiment, comprising:

- a different wiring of the electric terminals 12 of the photo-voltaic module 100 and/or 101;
- at least one electrolytic capacitor or accumulator 106 placed between the internal surface of the containing means 102 and the lower

supporting surface 11 of the photo-voltaic module 100 and/or 101, suitable to accumulate the electric energy generated by the module 100 and/or 101 and to make it available to be used without a primary solar source; the dielectric fluid circulates inside the electrolytic capacitor or accumulator 106, and performs an insulating function between the plates of the electrolytic capacitor or accumulator 106;

- at least one control circuit 109 (composed for example of a positive booster circuit) placed in the room 14 of the closing means 104 of the containing means 102, such control circuit 109 being suitable to boost the voltage of the electric energy generated by the module 100 and/or 101 and to send it to the electrolytic capacitor or accumulator 106;

- at least one micro-inverter 111 placed in the closing means 104 of the transparent containing means 102 and connected to the connector 24 of the covering and fastening means 107, such micro-inverter 111 being adapted to withdraw the electric energy accumulated as direct current in the electrolytic capacitor or accumulator 106 and to transform it into alternate current.

Moreover, the hybrid solar generator 1, as shown in Figures 5, 9, 15 and 16, has a fourth preferred embodiment, comprising at least one heat exchanger 105 placed between the internal lower surface of the containing means 102 and the lower surface of the module 100 and/or 101, at least one upper closing means 103 distinguished from the upper closing means 104 due to the presence of at least two holes 18 and 19 adapted to pass at least one cooling fluid (dielectric or not, such as, for example, a mixture of water and antifreezing liquid) inside the heat exchanger 105. The closing means 103 comprise at least one thermal probe suitable to detect a temperature value of the dielectric fluid present inside the containing means 102, and to send a signal through the connector 23 placed on the covering and fastening means 107 to a remote controller.

Such remote controller, when the signal received from the thermal probe exceeds the preset activation temperature value, generates both an indirect cooling of the module 100 and/or 101 inducing in the heat exchanger 105 a forced circulation of the cooling fluid, and the direct cooling of such module 100 and/or 101, inducing

therein a forced circulation of the dielectric fluid inside the containing means 102.

Moreover, such remote controller can activate the direct cooling also without the signal coming from the thermal probe, comparing at least one value of the external temperature of the environment in which the hybrid solar generator 1 according to the present invention is placed, detected by an external thermal probe and at least one electric power value generated by the photo-voltaic module 100 and/or 101.

Moreover, the hybrid solar generator 1, as shown in Figures 17 and 18, has a fifth preferred embodiment, comprising a different wiring of the electric terminals 12 and a system for signalling a position and transmitting data of the photo-voltaic module 100 and/or 101; the signalling system in particular comprises:

- at least one diode bar 114 with liminous emission placed inside the containing means 102 along the side surface of the module 100 and/or 101, electrically supplied by the electric energy taken from the electrolytic capacitor or accumulator 106;
- at least one electronic control module 113

inserted into the closing means 104 and connected to the connector 24 to allow managing the module 100 and/or 101 also from a possible external control unit.

Finally, the hybrid solar generator 1, as shown in Figures 19 to 29, has further preferred embodiments obtained from the various possible combinations of two or more of the features of the previously described preferred embodiments.

The hybrid solar generator 1 according to the present invention, therefore, has the following advantages:

- allowing to use, inside the hybrid solar generator, any existing photo-voltaic module, equipped or not with a possible protecting surface layer made of Ethylen Vinyl Acetate (EVA);
- integrating two different cooling systems of the photo-voltaic module, inserted inside the hybrid solar generator, maximising its efficiency and guaranteeing its use under extreme environmental conditions with very high external temperatures;
- ensuring the operation of the hybrid solar generator during a possible contact or immersion

thereof into liquid substances, guaranteeing its airtightness;

- guaranteeing a protection of the hybrid solar generator against thefts through a GPS locating device with annexed power module, which enables or disables the electric energy supply of the photo-voltaic module;

- guaranteeing the operation of the hybrid solar generator also without a primary solar source, through its integration with an electrolytic accumulator;

- delivering alternate current electric energy, since the hybrid solar generator comprises an inverter integrated therein;

- guaranteeing operating conditions with maximum efficiency for the photo-voltaic module contained in the hybrid solar generator arranged for the solar following or other objects through a rotation along its own axis;

- providing the hybrid solar generator with an active system for luminous position signalling and data transmission through luminoos pulses;

- allowing to install the hybrid solar generator on different surfaces;

- preventing the deterioration of the photo-voltaic module contained inside the hybrid solar generator, improving its working life;
- reducing the production costs of the photo-voltaic modules, allowing the use in the hybrid solar generator of photo-voltaic modules which, lacking the EVA surface layer, can be re-used and re-cycled;
- simplifying the manufacturing methodologies of an hybrid solar generator and reducing installation times and costs for the system;
- reducing possible over-pressure problems inside the hybrid solar generator by using dielectric fluids capable of being compressed.

CLAIMS

1. Hybrid solar generator (1), characterised in that it comprises at least one photo-voltaic module (100; 101) contained inside at least one containing means (102) which is at least partially transparent, said module (100; 101) being immersed at least partially into at least one dielectric fluid contained inside said containing means (102).

2. Hybrid solar generator (1) according to claim 1, characterised in that said dielectric fluid is a refrigerating dielectric fluid in liquid or gaseous form or a mixture of dielectric refrigerating fluids in liquid or gaseous form.

3. Hybrid solar generator (1) according to claim 1, characterised in that said photo-voltaic module (101) is covered by at least one protecting surface layer (13), said layer (13) being preferably made of Ethylen Vinyl Acetate (EVA).

4. Hybrid solar generator (1) according to claim 1, characterised in that said photo-voltaic module (100; 101) is composed of photo-voltaic cells (10) made of amorphous crystalline or polycristalline silicon, arranged on an upper supporting surface (11) of said modules (100; 101) and mutually connected through electric terminals (12).

5. Hybrid solar generator (1) according to claim 1, characterised in that said containing means (102) have a substantially cylindrical shape and said photo-voltaic module (100; 101) is placed along a median line of said cylindrical containing means (102).

6. Hybrid solar generator (1) according to claim 1, characterised in that said containing means (102) comprise at least two closing means (104) and at least two covering and fastening means (107) adapted to perform an airtight sealing of said containing means (102), said closing means (104) comprising:

- at least one room (14) adapted to house at least one electronic control board and at least one or more other electric components suitable for at least one electric wiring;
- one or more holes (15) adapted to pass electric connections between said transparent containing means (102) and said electronic board;
- at least one hole (17) adapted to pass said dielectric fluid inside said transparent containing means (102);
- at least one duct (20) adapted at least to

allow an injection of at least one o more sealing resins inside said closing means (104);

- at least two sealing gaskets (21);
- at least one hole (22) for placing at least one thermal probe inside said transparent containing means (102);
- at least one threaded hole (32) adapted to fasten said covering and fastening means (107) onto said closing means (104), said duct (20) being preferably obtained inside at least one of said threaded holes (32).

7. Hybrid solar generator (1) according to claim 6, characterised in that said covering and fastening means (107) is adapted to fasten said hybrid solar generator (1) to at least one supporting structure and comprises:

- at least one lever-type system (108), associated with said covering and fastening means (107) through at least one fastening hole (27);
- at least one direct current (DC) electric connector (23) connected to at least one electric terminal (12) of said photo-voltaic module (100; 101);
- at least one alternate current (AC) electric

connector (24);

- at least one fastening hole (26) adapted to fasten said covering and fastening means (107) to said closing means (104) through at least one of said threaded holes (32);

- at least one fastening hole (28) adapted to guarantee at least one fixed positioning of said hybrid solar generator (1).

8. Hybrid solar generator (1) according to claim 6, characterised in that said lever-type system (108) comprises at least one fulcrum (30) and at least one hole (29), said lever-type system (108) being adapted to allow a rotation of said hybrid solar generator (1) along its own axis, favouring a solar following (200) of said hybrid solar generator (1).

9. Hybrid solar generator (1) according to claim 6, characterised in that said thermal probe is adapted to detect at least one temperature value of said dielectric fluid present inside said containing means (102), and to send at least one signal through said connector (23) to at least one remote controller adapted to perform a direct cooling of said module (100; 101) inducing a forced circulation of said dielectric fluid inside said

transparent containing means (102), when said temperature value exceeds at least one activation temperature value.

10. Hybrid solar generator (1) according to any one of the previous claims, characterised in that it comprises at least one GPS locating device (110) equipped with at least one power circuit adapted to enable and/or disable at least a delivery activity of electric energy of said photo-voltaic module (100; 101).

11. Hybrid solar generator (1) according to any one of the previous claims, characterised in that it comprises:

- at least one electrolytic capacitor or accumulator (106) placed between an internal surface of said containing means (102) and a lower supporting surface (11) of said module (100; 101), said electrolytic capacitor or accumulator (106) being adapted to accumulate said electric energy generated by said photo-voltaic module (100; 101) and to make it available to be used without a primary solar source;

- at least one control circuit (109) placed in said room (14) in said closing means (104) of said transparent containing means (102), said control

circuit (109) being adapted to boost at least one voltage value of said electric energy generated by said module (100; 101) and to send it to said electrolytic capacitor or accumulator (106);

- at least one micro-inverter (111) placed in said closing means (104) of said containing means (102) and connected to said connector (24) of said covering and fastening means (107), said micro-inverter (111) being adapted to take electric energy accumulated as direct current in said electrolytic capacitor or accumulator (106) and to transform it into alternate current.

12. Hybrid solar generator (1) according to any one of the previous claims, characterised in that it comprises at least one heat exchanger (105) placed between an internal lower surface of said containing means and a lower surface of said module (100; 101) and at least one upper closing means (103) comprising at least two holes (18, 19) adapted to pass at least one cooling fluid inside said heat exchanger (105).

13. Hybrid solar generator (1) according to the previous claim, characterised in that said remote controller is further adapted to perform an indirect cooling of said module (100; 101) inducing

a forced circulation of said cooling fluid in said heat exchanger (105).

14. Hybrid solar generator (1) according to any one of the previous claims, characterised in that said remote controller is adapted to activate said direct cooling also without said signal coming from said thermal probe, by comparing at least one external temperature value of an environment in which said hybrid solar generator (1) is placed through an external thermal probe and at least one electric power value generated by said photovoltaic module (100; 101).

15. Hybrid solar generator (1) according to any one of the previous claims, characterised in that it comprises at least one system for position signalling and data transmission of said photovoltaic module (100; 101), said signalling system comprising:

- at least one diode bar (114) with luminous emission placed inside said containing means (102), transparent along a side surface of said module (102) and elecrically supplied by electric energy taken from said electrolytic capacitor or accumulator (106);
- at least one electronic control module (113)

inserted into said closing means (104) and connected to said connector (24), said electronic control module (113) being adapted to allow managing said module (100; 101) through at least one external control unit.

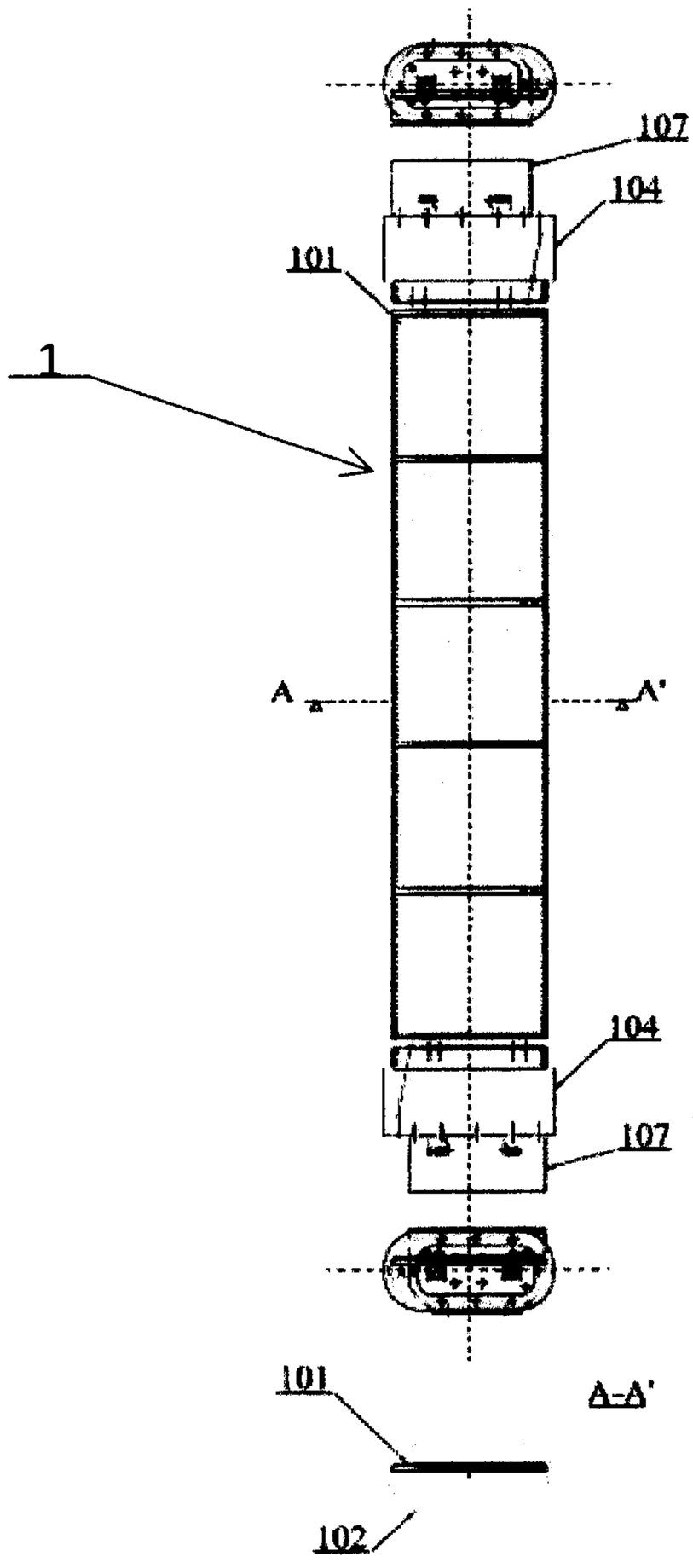
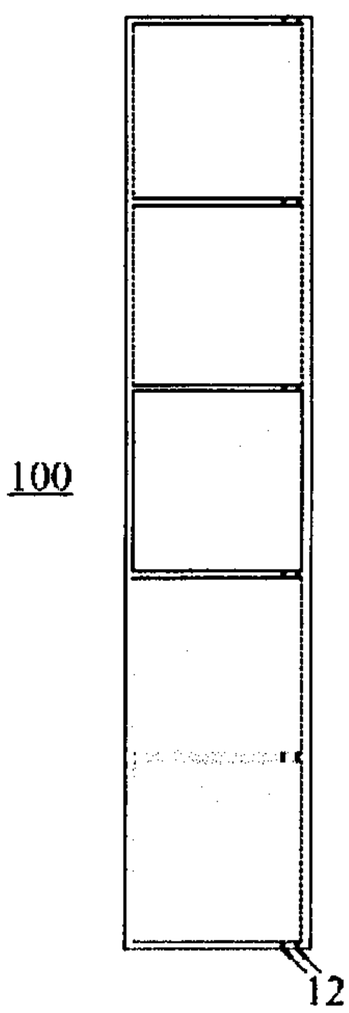


FIG. 1

FIG. 2



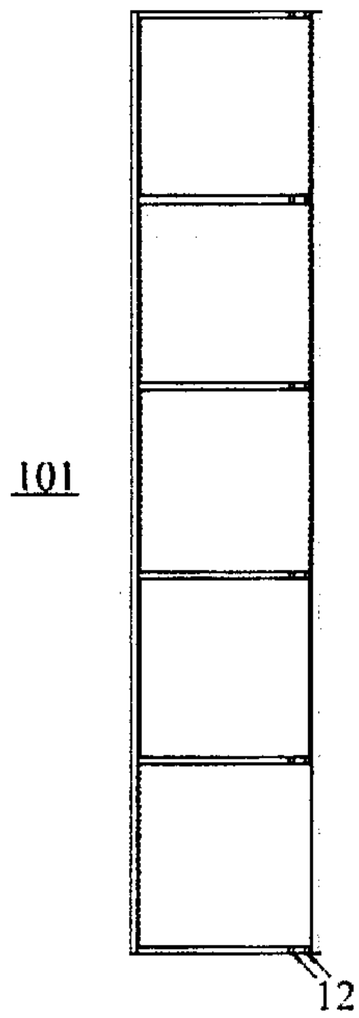


FIG. 3

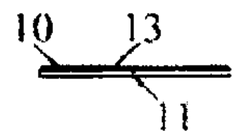


FIG. 4

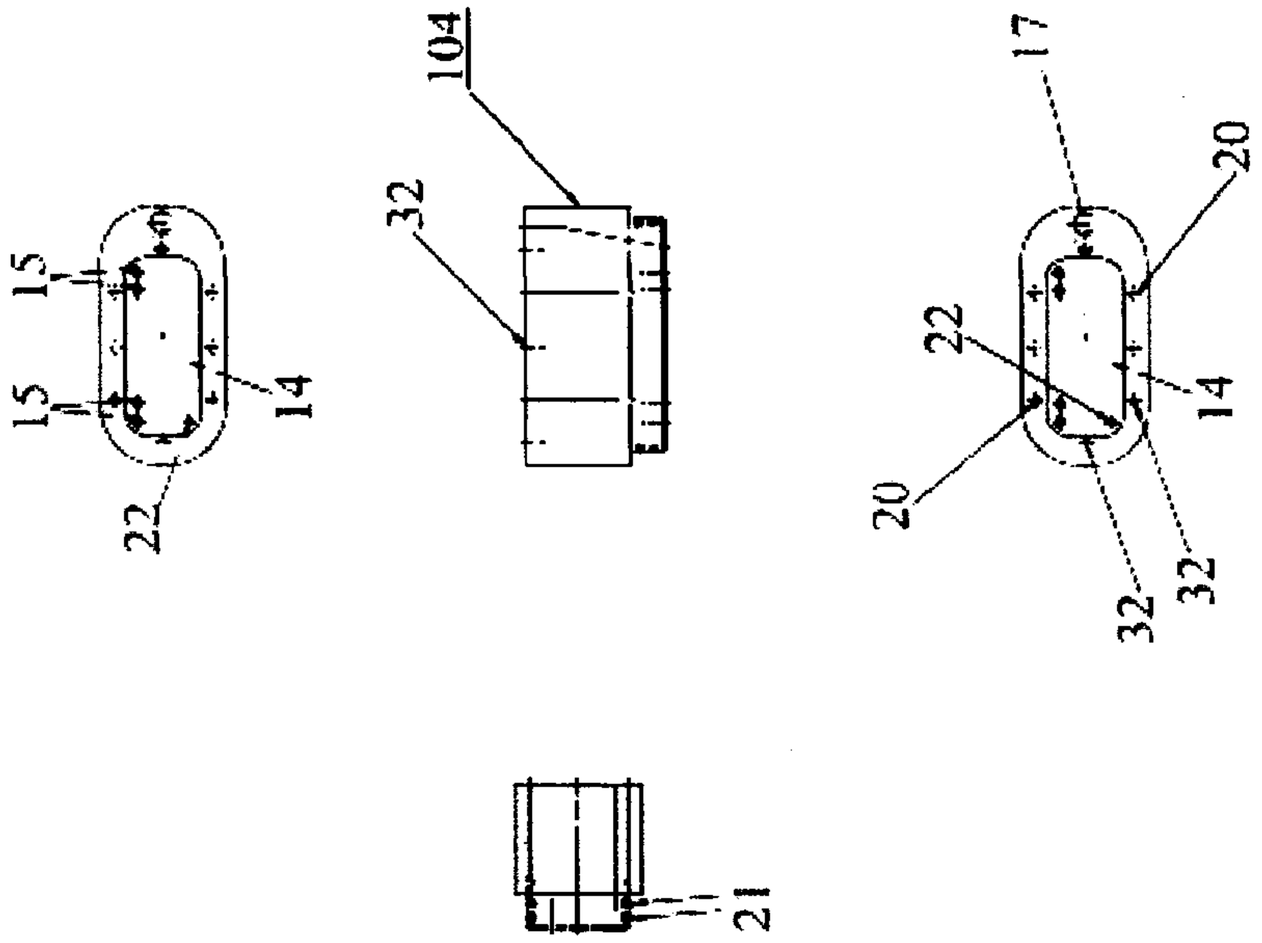

15
15
22
14
104
32
17
20
22
14
20
32
32
21

FIG. 6

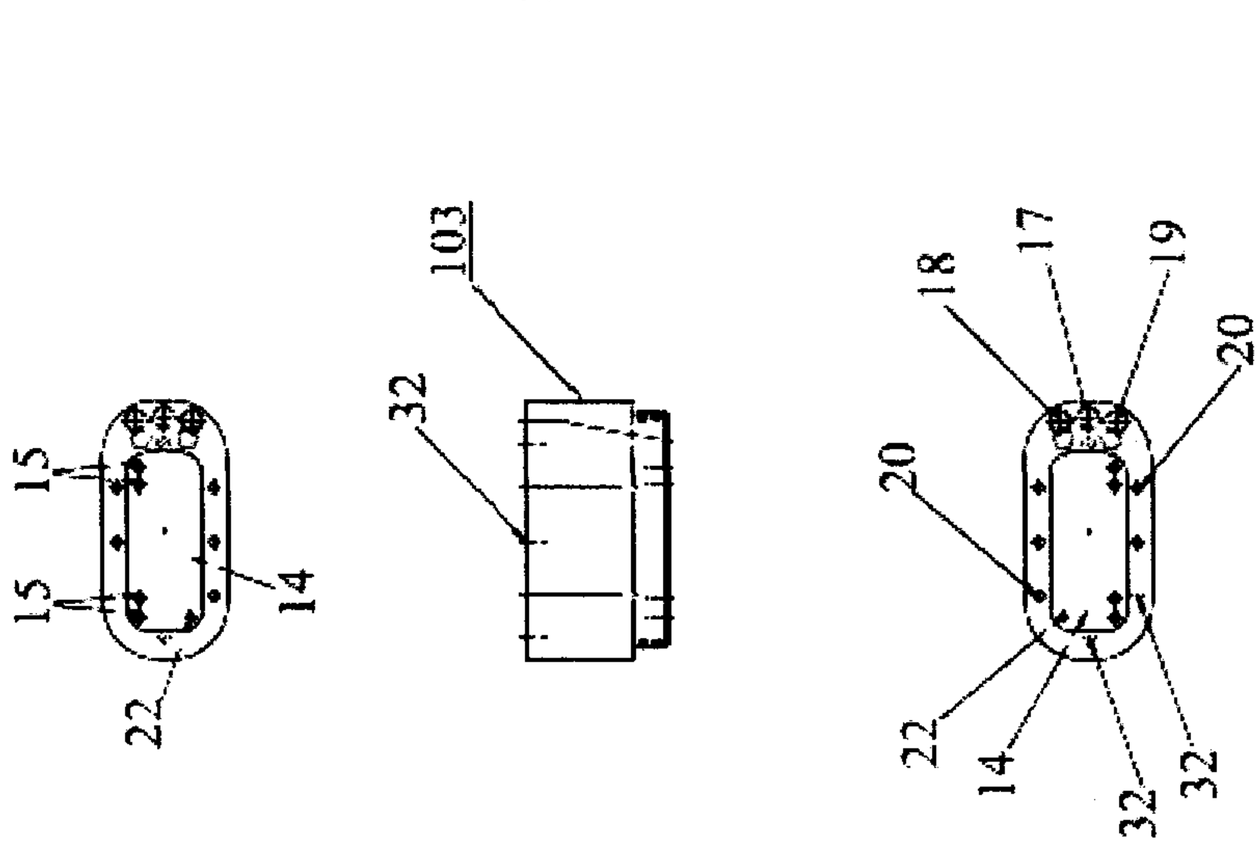

15
15
22
14
103
32
18
17
19
20
20
22
14
32
32
21

FIG. 5

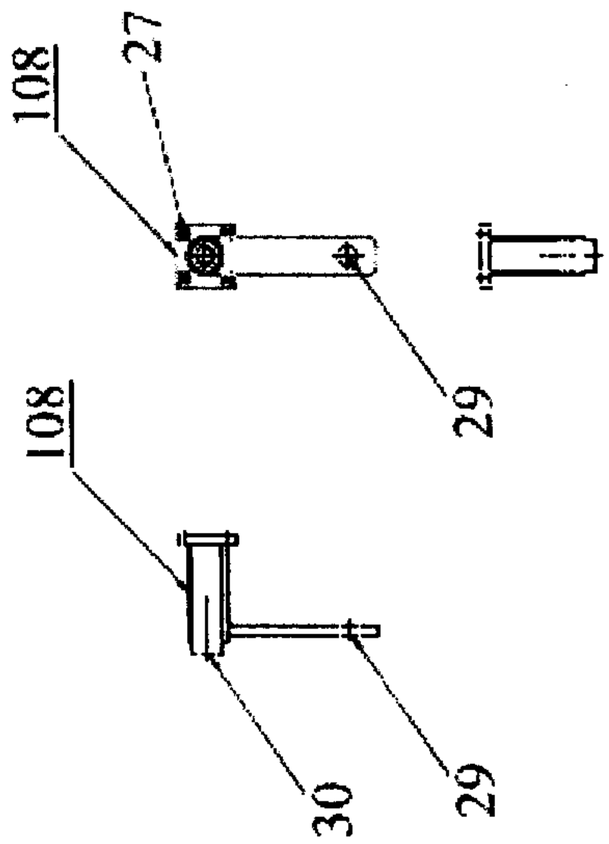


FIG. 8

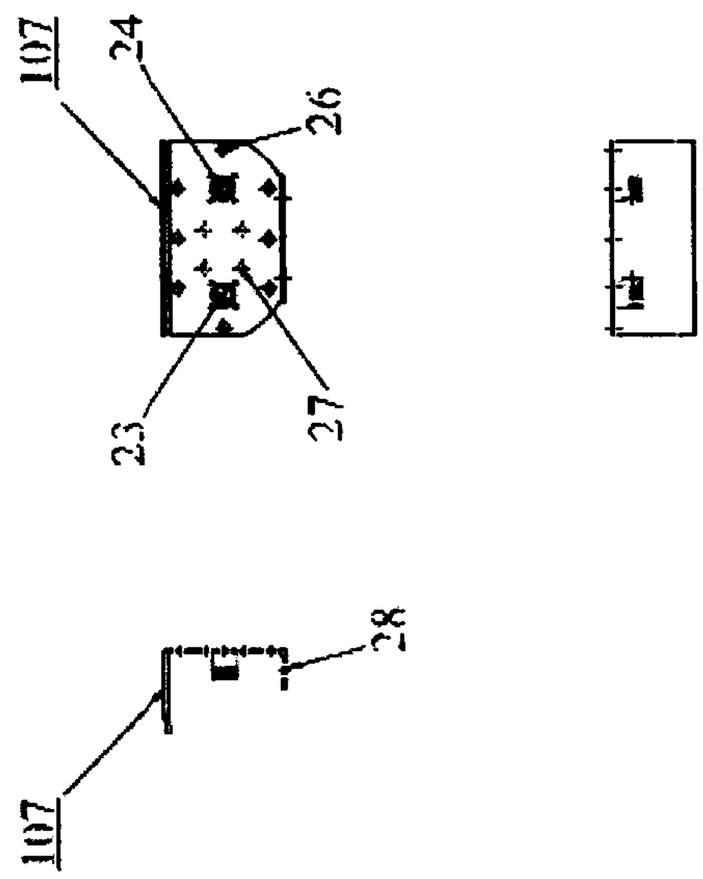


FIG. 7

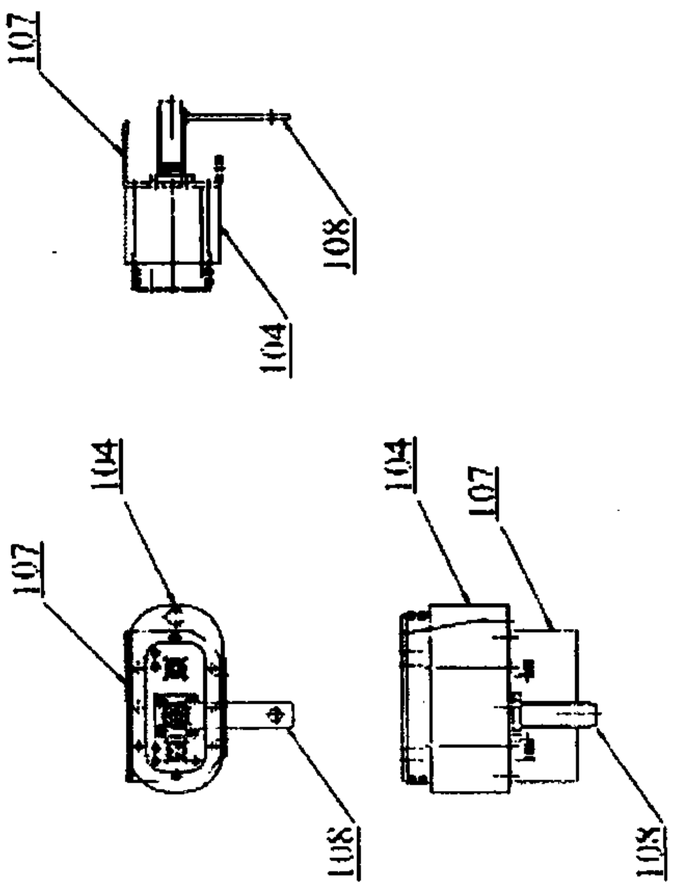

107
108
104
107
104
104
107
108
108

FIG. 10

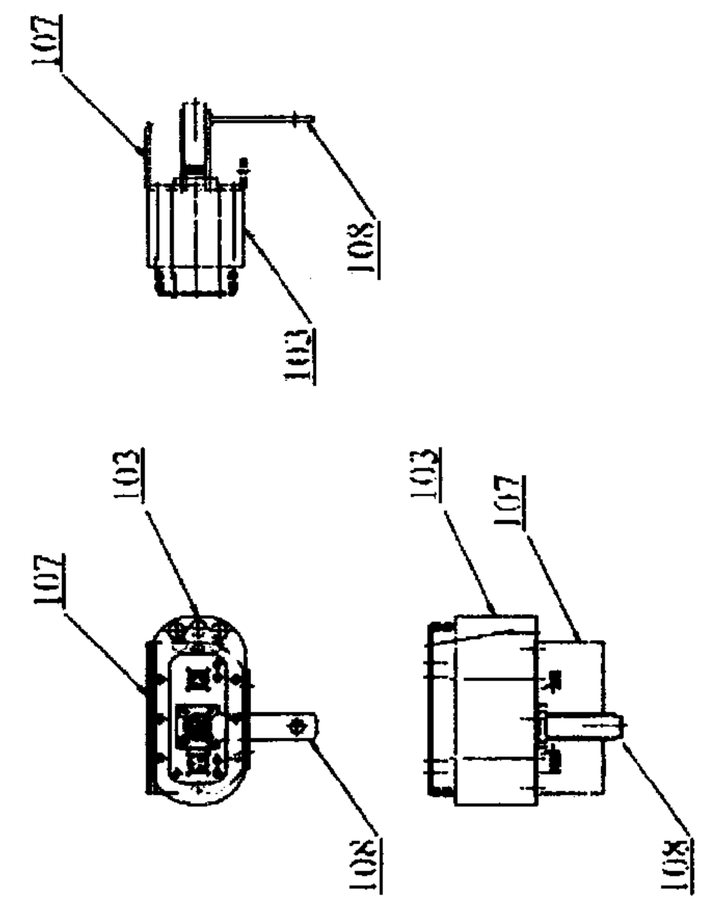

107
108
103
103
107
108
103
107
108

FIG. 9

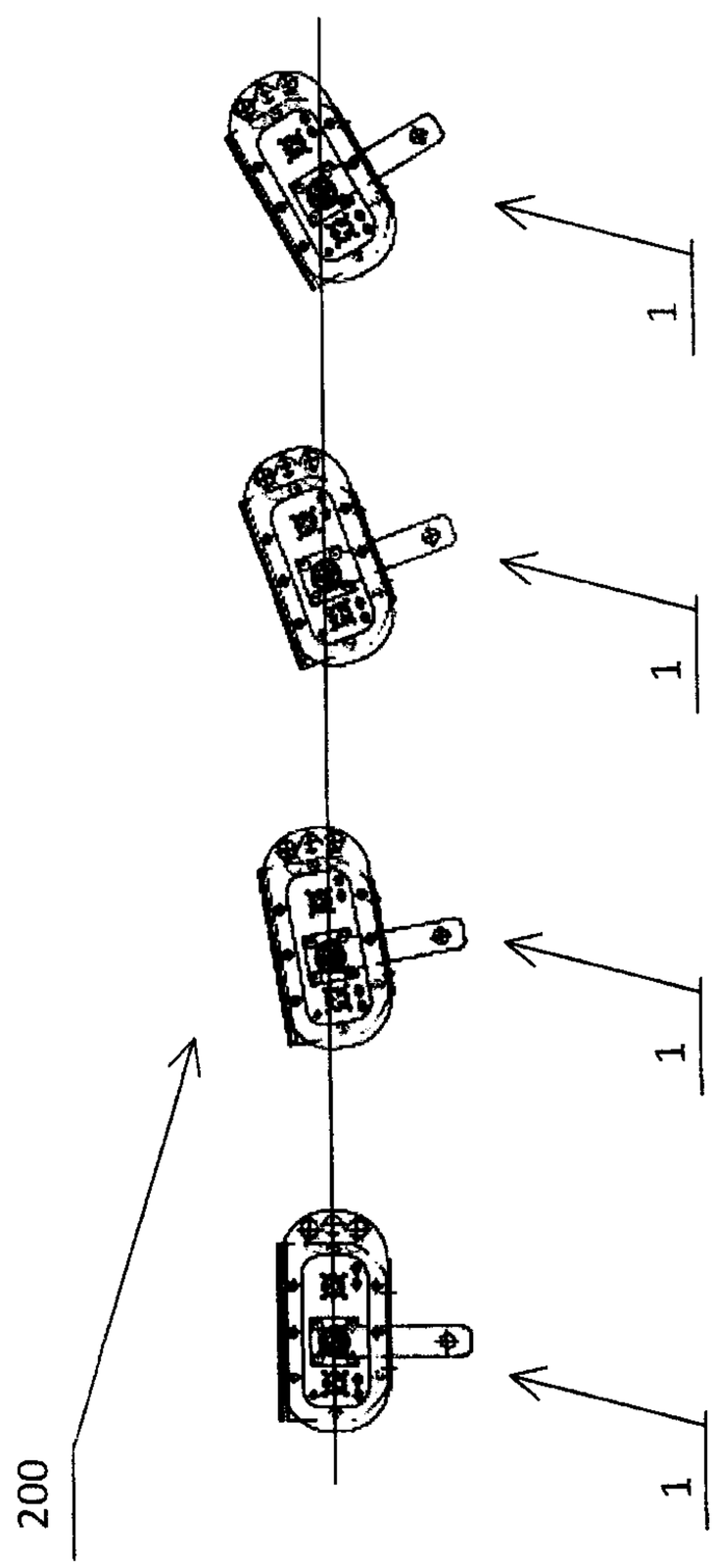


FIG. 11

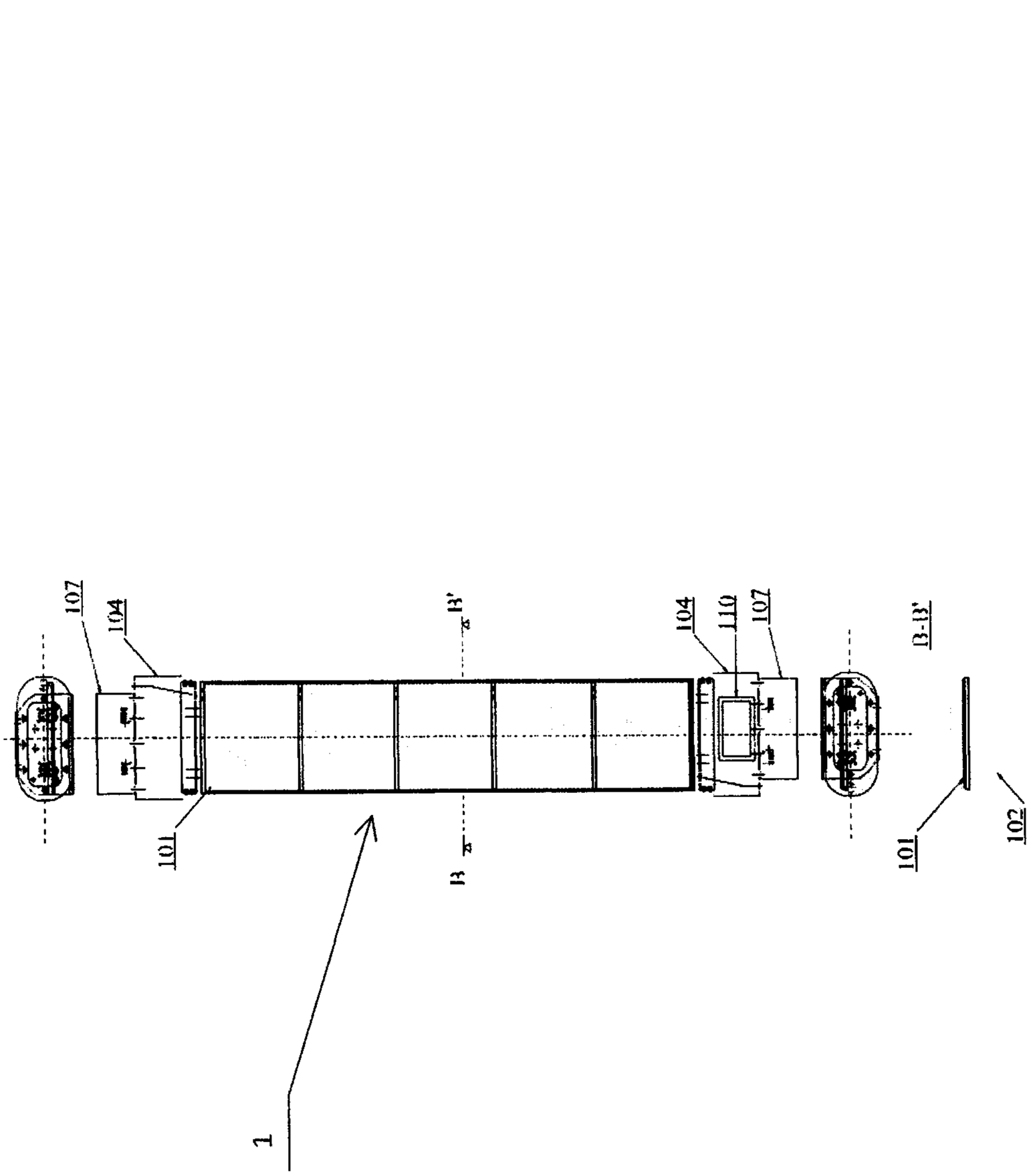


FIG. 12

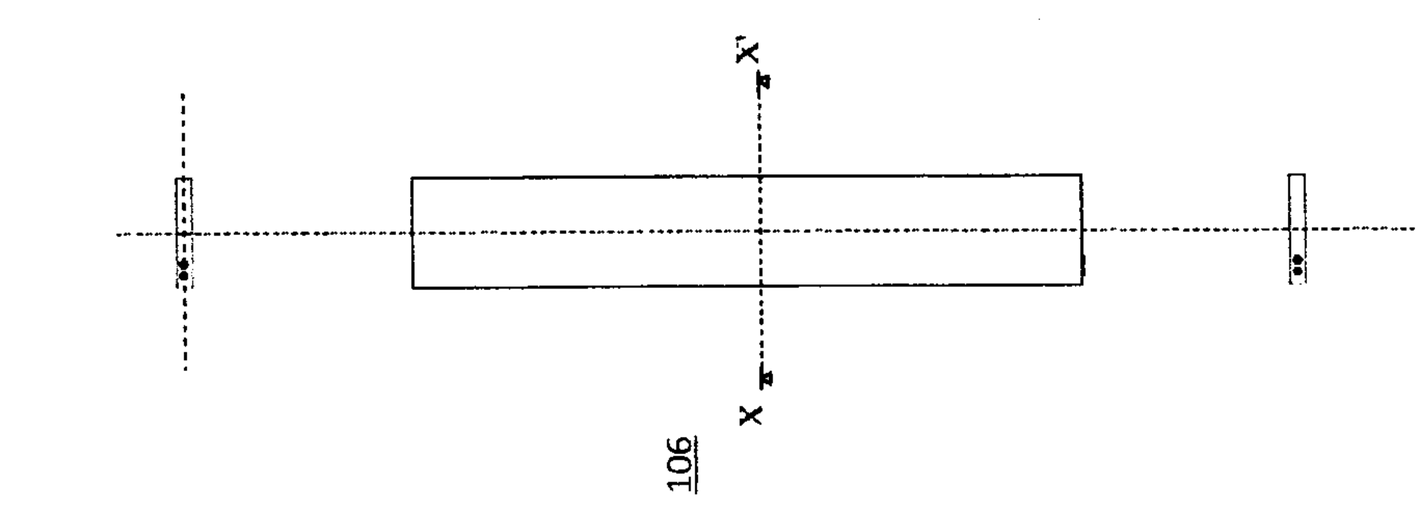

X'
X
106
X-X'

FIG. 14

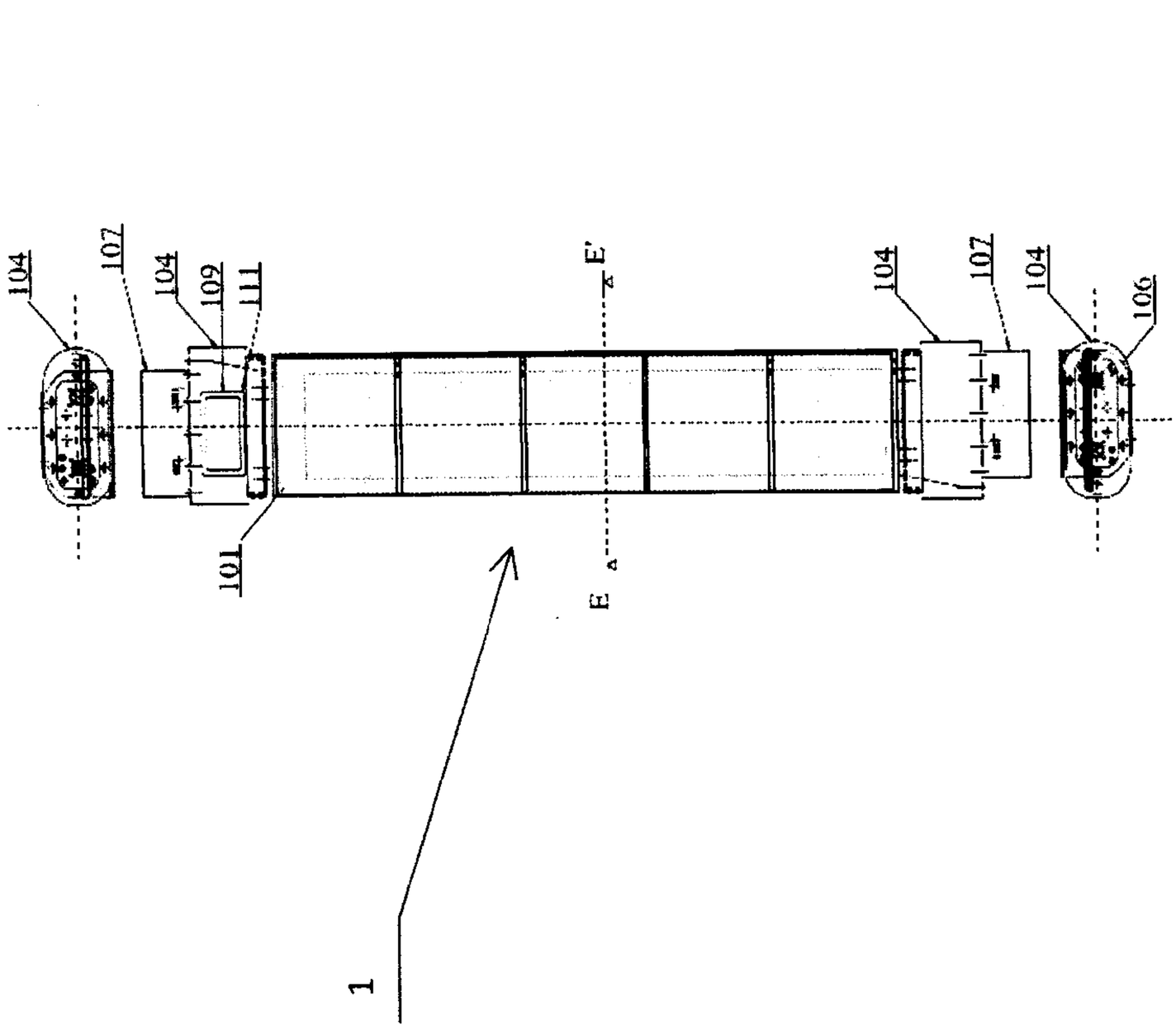

104
107
104
109
111
E'
E
104
107
104
106
101
F-F'
106
101
102
1

FIG. 13

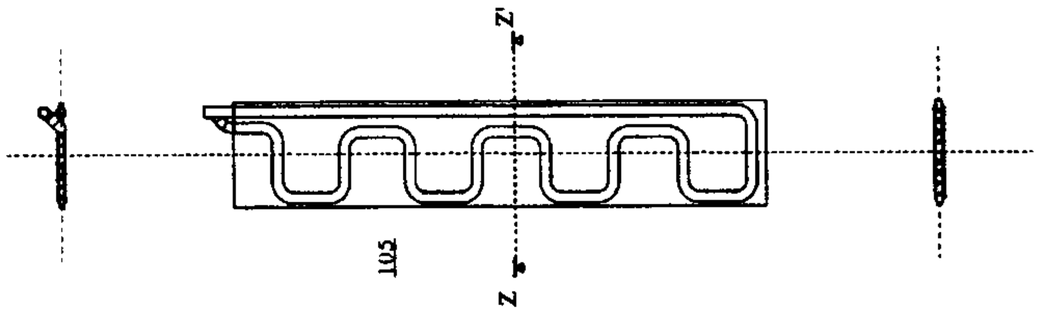


FIG. 16

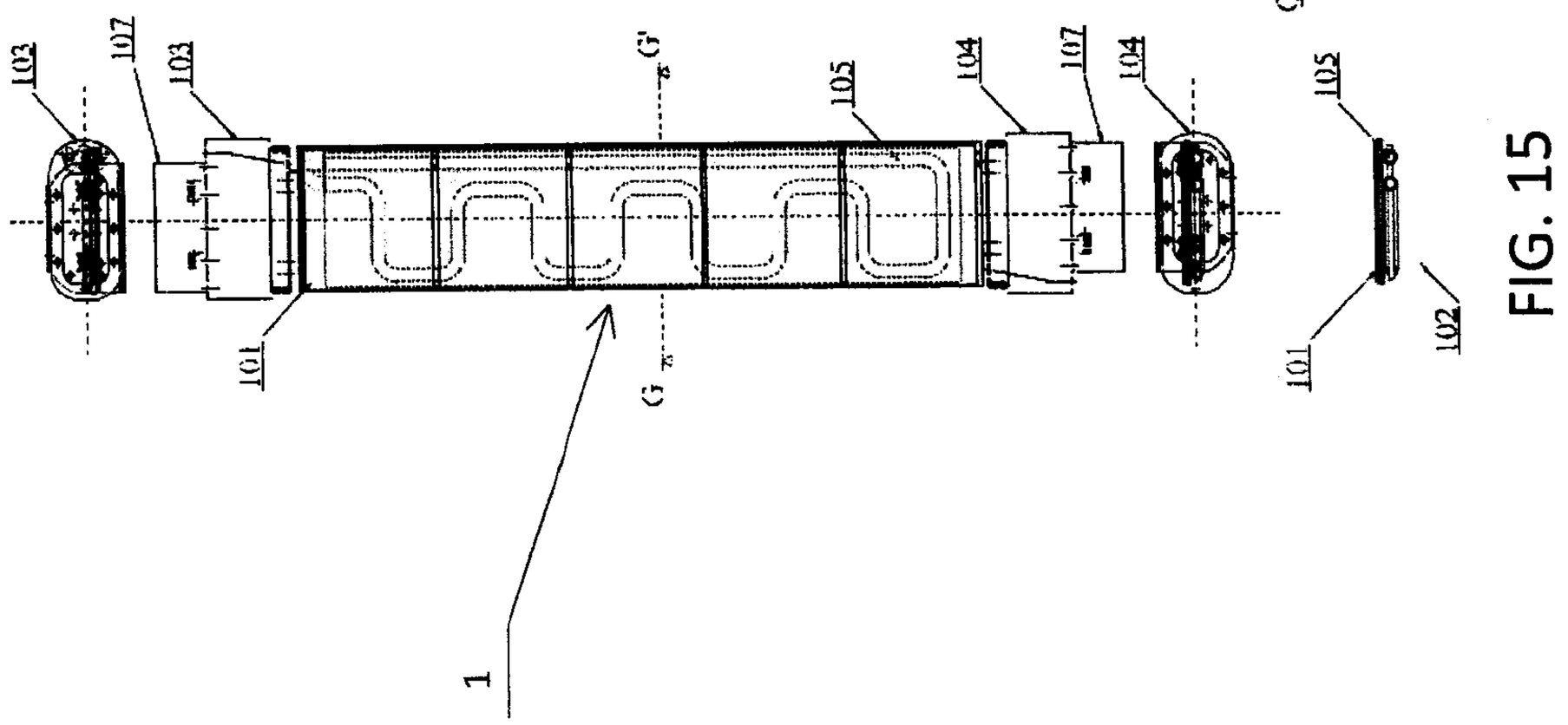


FIG. 15

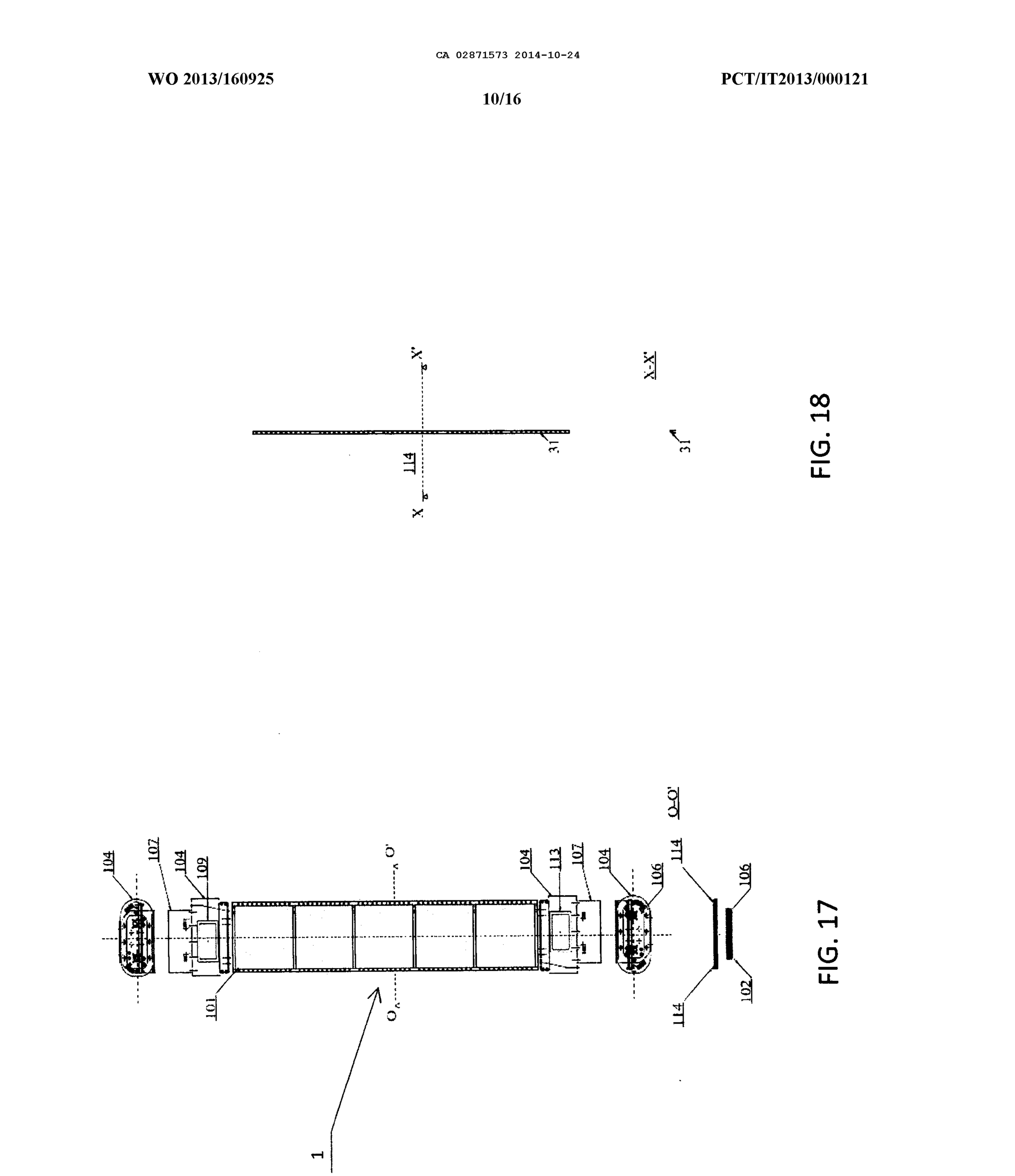


FIG. 17

FIG. 18

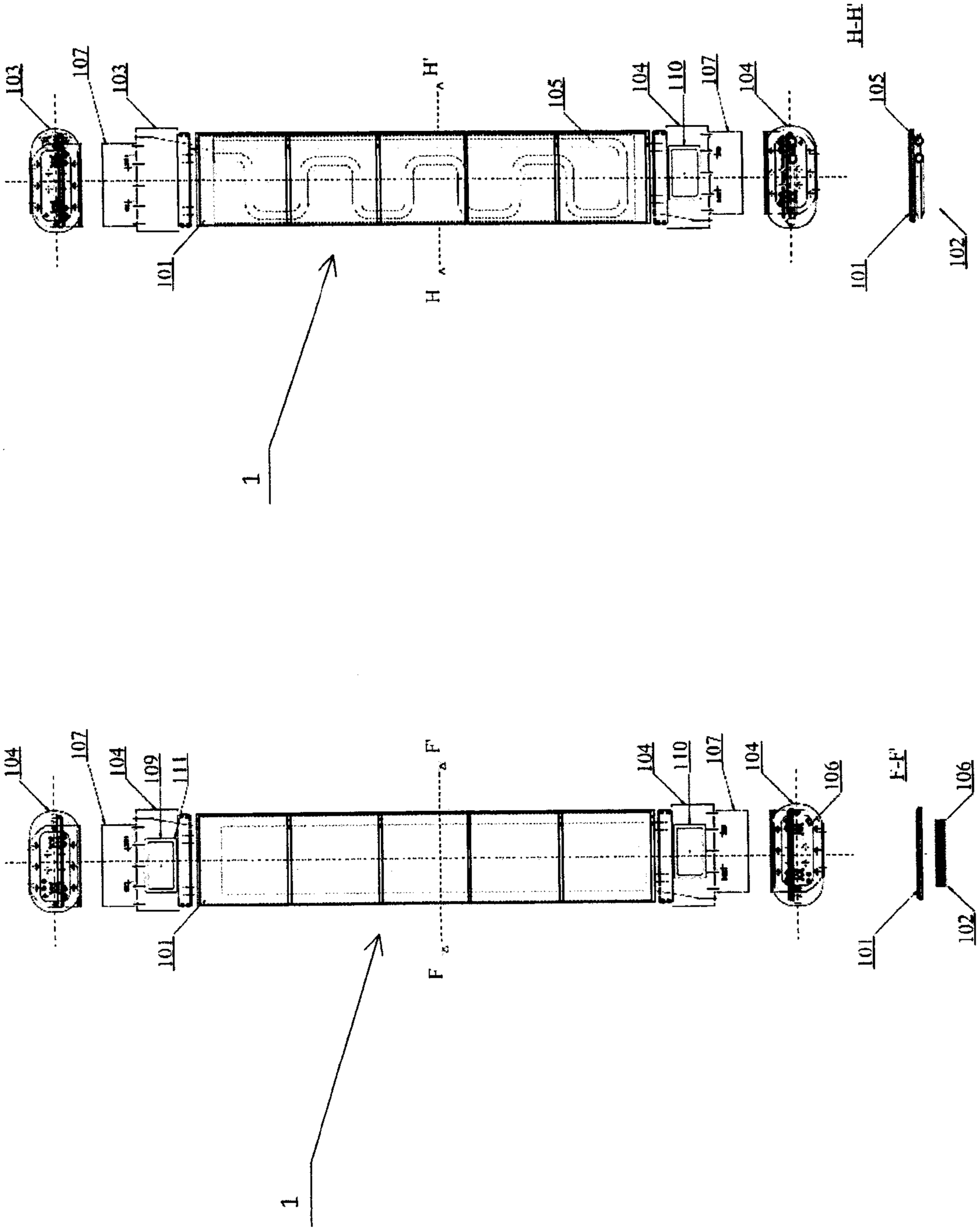

103
107
103
H'
105
104
110
107
104
105
H-H'
101
H
101
102
1

FIG. 20

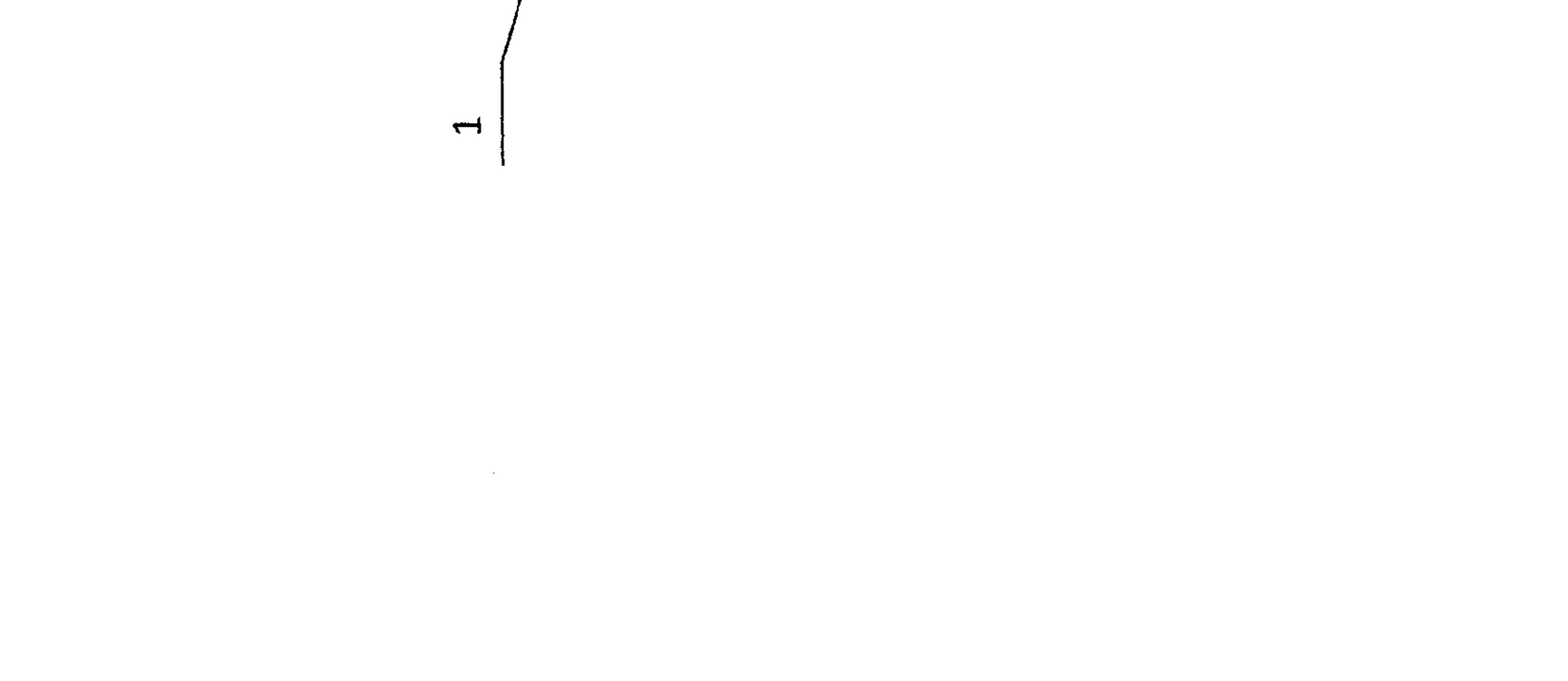

104
107
104
109
111
F'
104
110
107
104
106
F-F'
106
101
F
101
102
1

FIG. 19

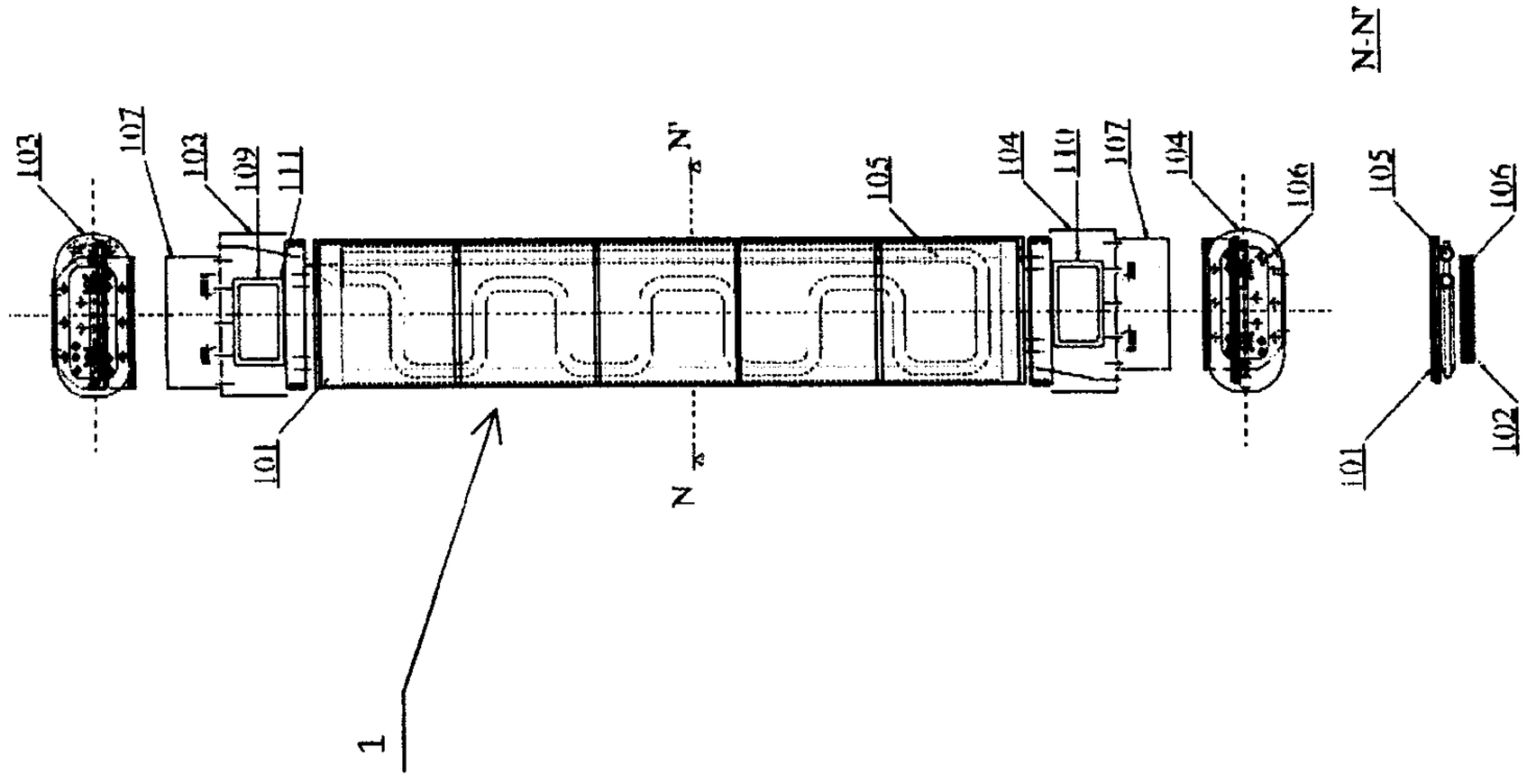

M-M'
103
107
103
109
111
M'
105
104
107
104
106
105
106
101
M
102
1

FIG. 21

N-N'
103
107
103
102
111
N'
105
104
110
107
104
106
105
106
101
N
102
1

FIG. 22

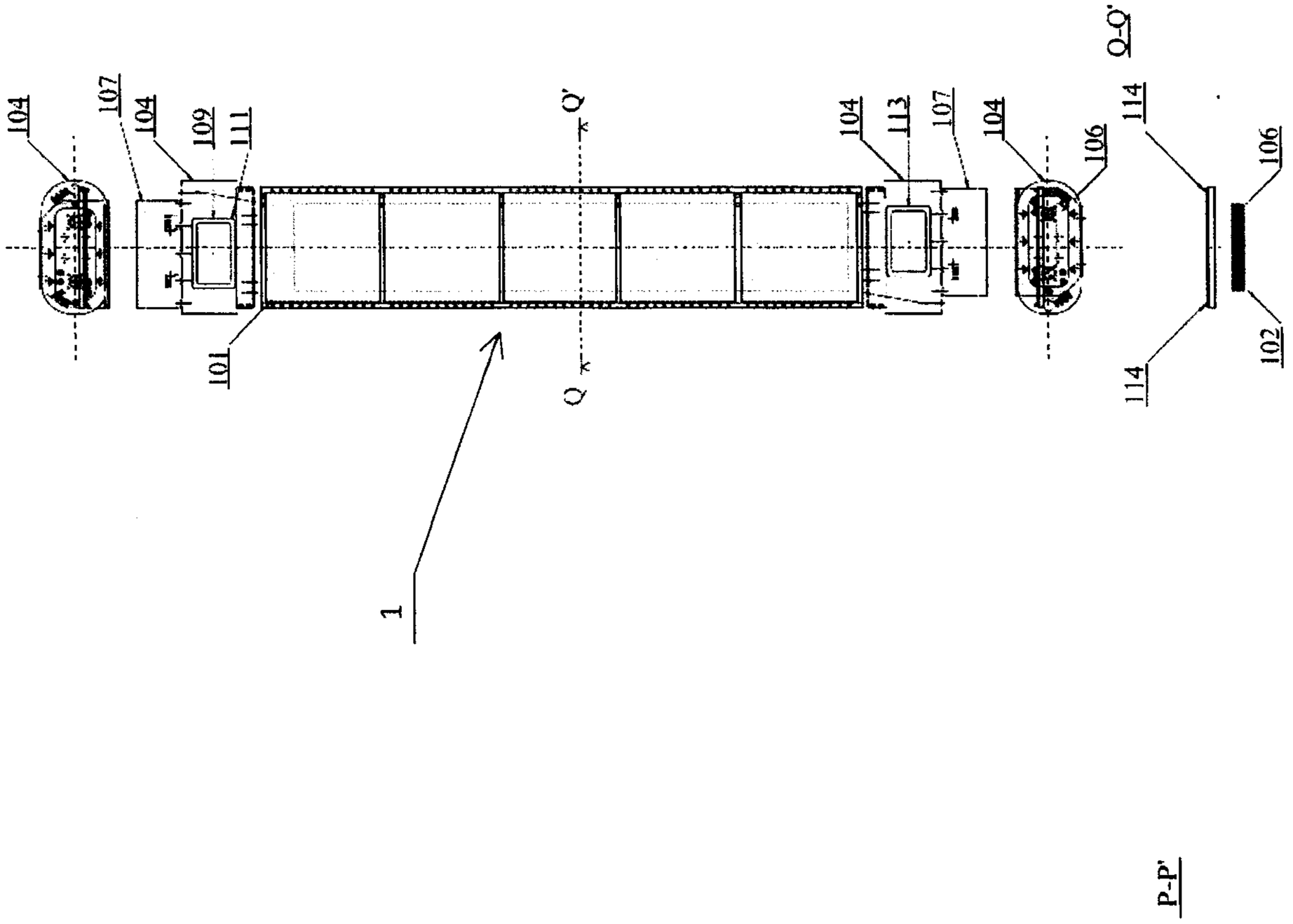

104
107
104
109
111
101
1
Q
Q'
104
113
107
104
106
114
106
102
114

FIG. 24

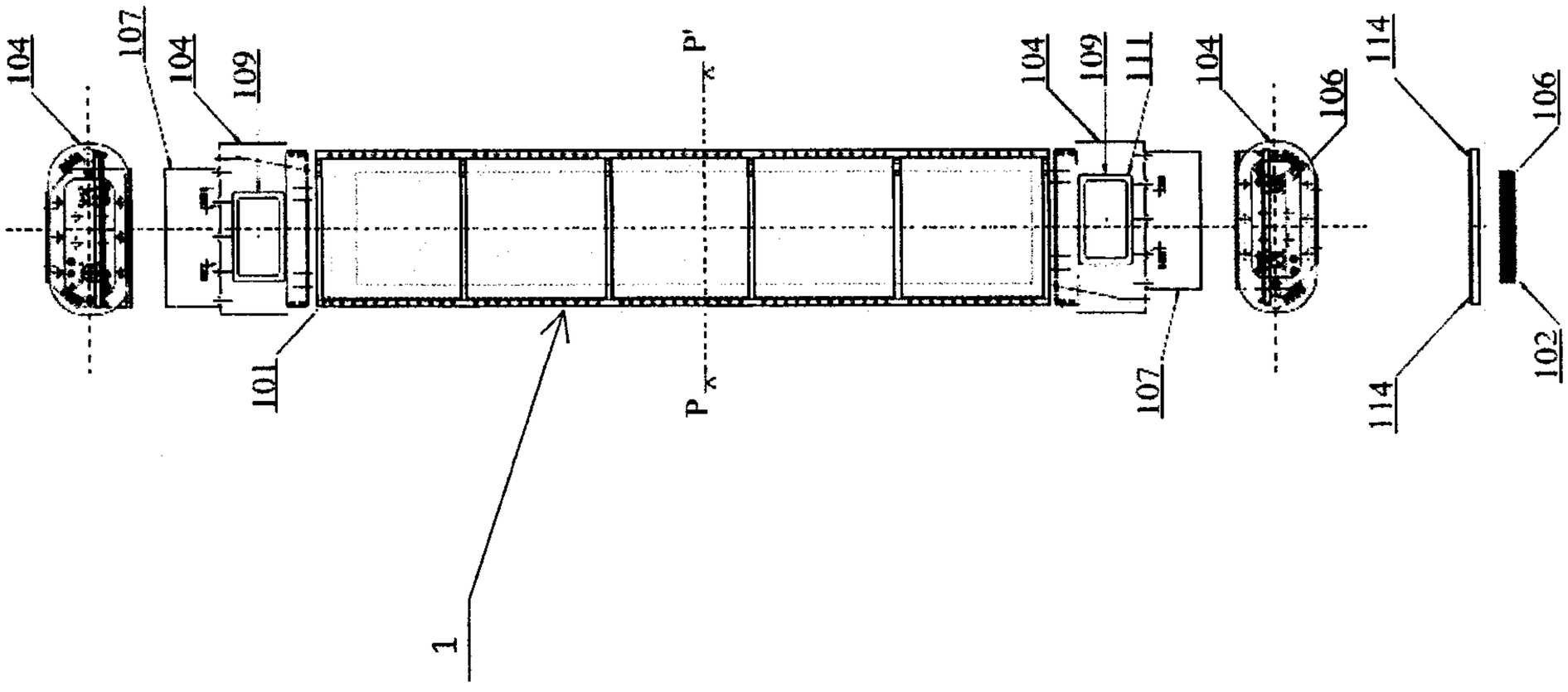

104
107
104
109
101
1
P
P'
104
109
111
107
104
106
P-P'
114
106
102
114

FIG. 23

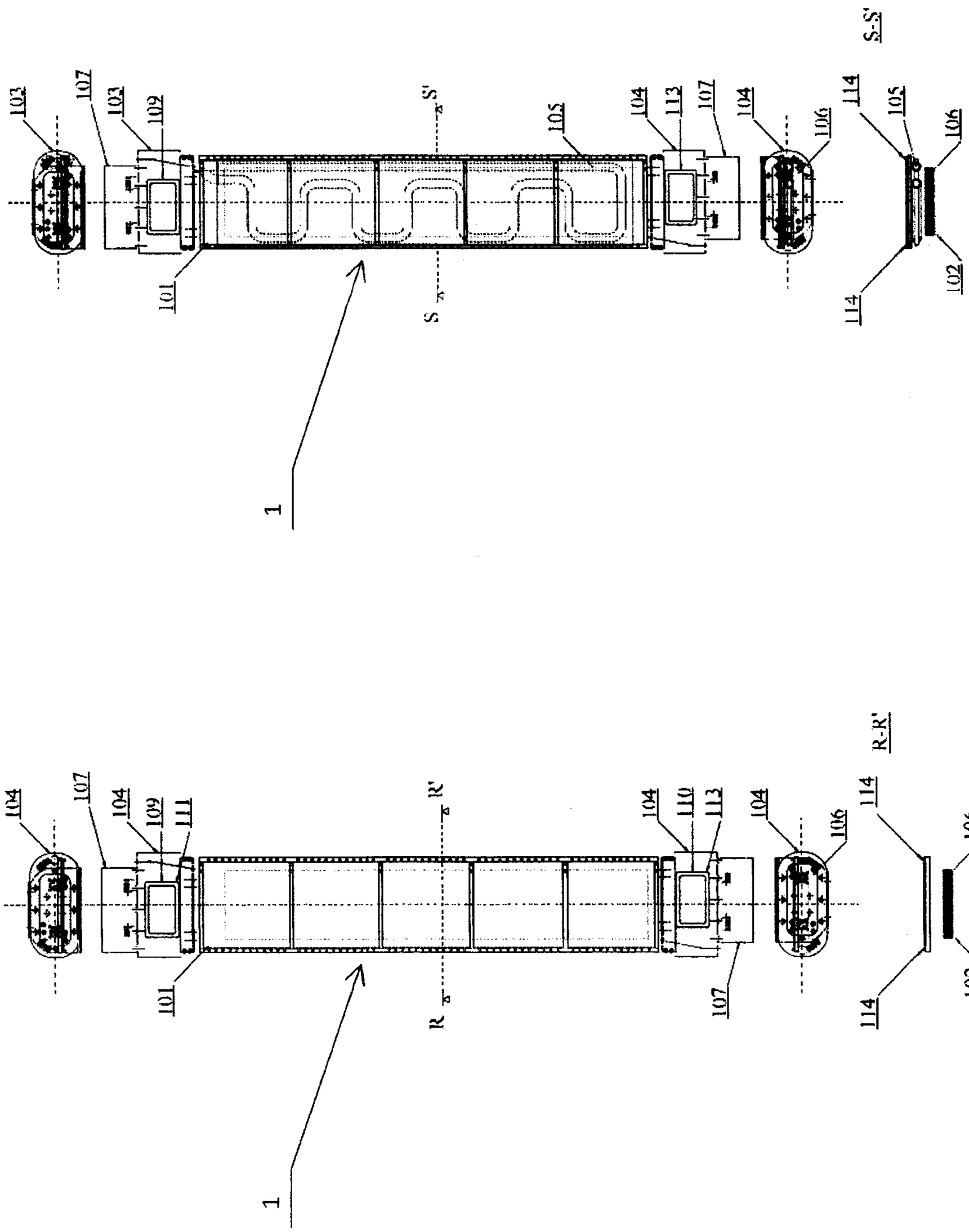

S-S'
103
107
103
102
101
S'
S
105
104
113
107
104
106
1
114
105
106
114
102

FIG. 26

R-R'
104
107
104
109
111
101
R
R'
104
110
113
107
104
106
1
114
106
114
102

FIG. 25

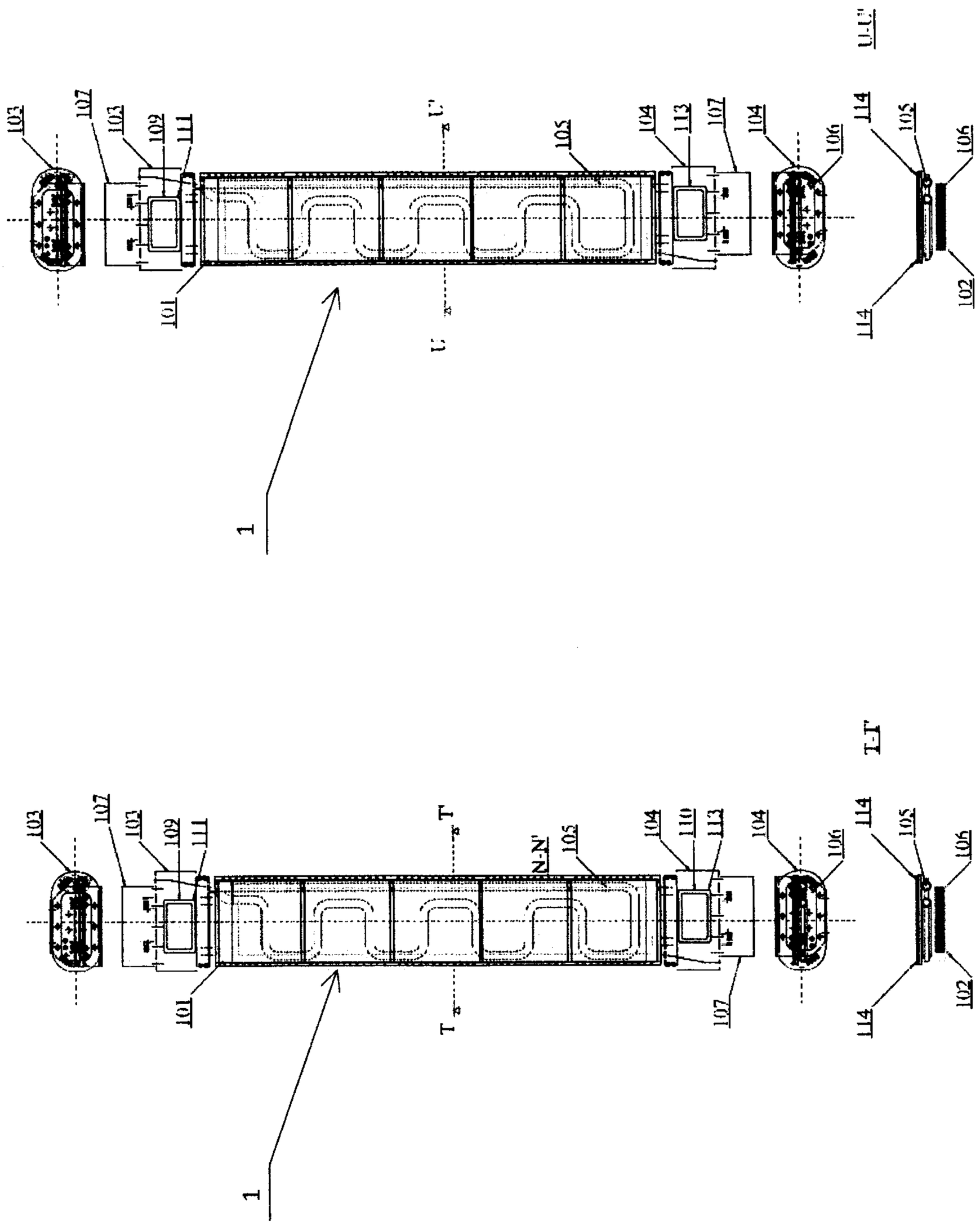

T-T'
103
107
103
102
111
101
105
104
113
107
104
106
114
105
106
102
114
1
T
T'
N-N'
109
110

FIG. 28

FIG. 27

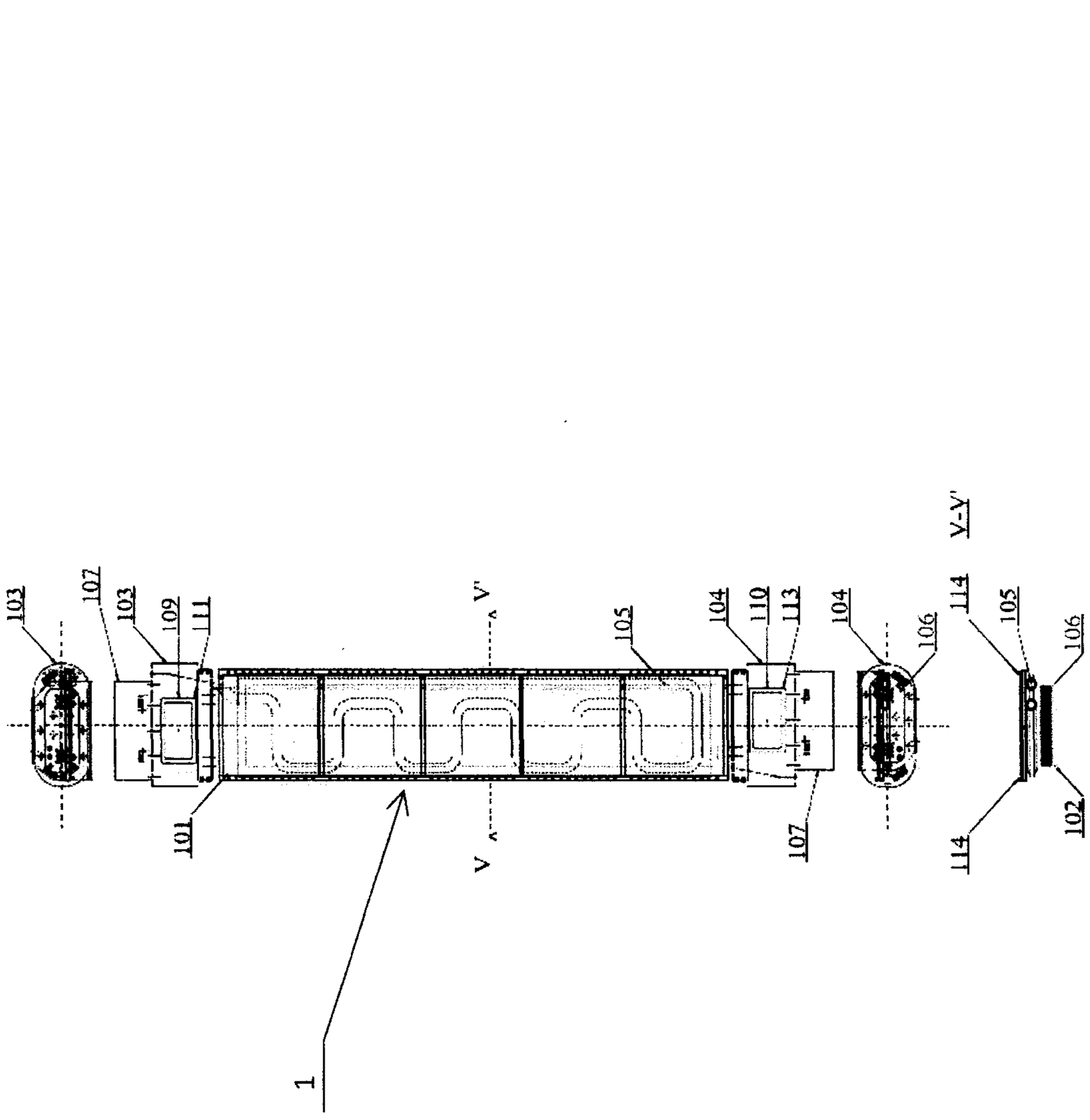

V-V'
103
107
103
109
111
V'
105
104
110
113
104
106
114
105
106
101
V
107
114
102
1

FIG. 29

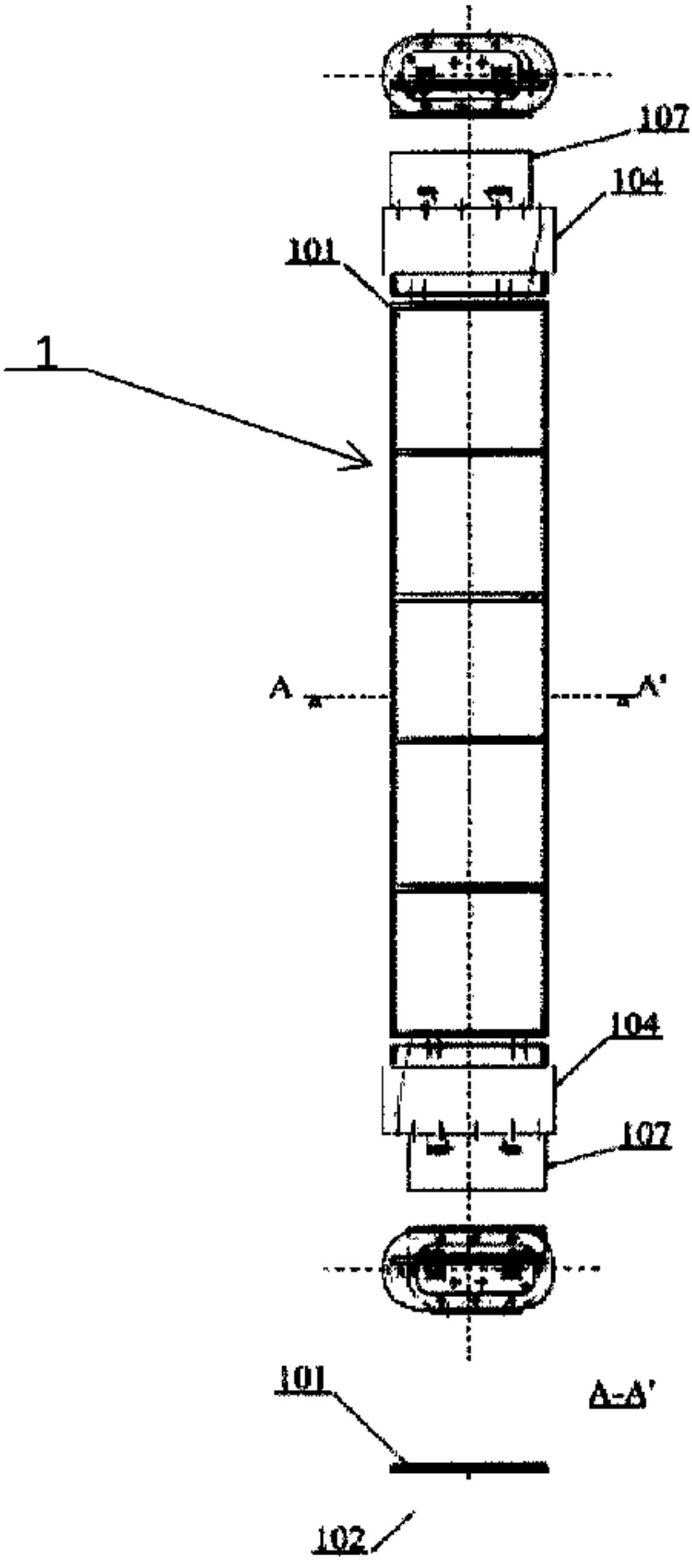


FIG. 1