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(54) SOLAR RADIATION MODULAR COLLECTOR

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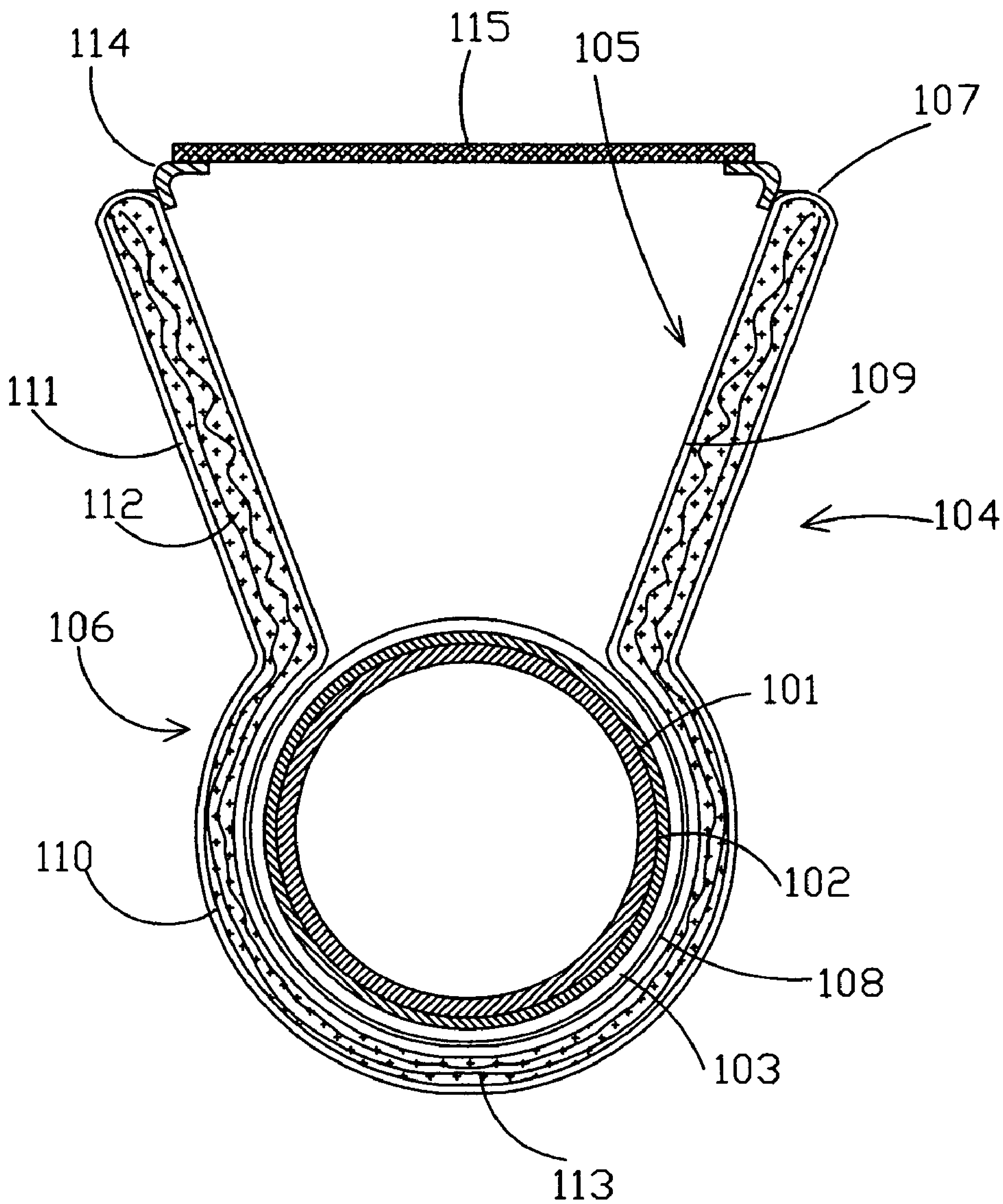
(57) **ABSTRACT**

The invention relates to the field of solar radiation collectors intended to convert energy of solar radiation into thermal energy, specifically, to the solar radiation collectors constructed as the combination of a concentrated solar radiation receiver, a single-curvature or compound-curvature concentrator and a tracking mechanism. A thermal insulation of the concentrated solar radiation receiver and the concentrated solar radiation receiver itself play a role of details in the tracking mechanism.



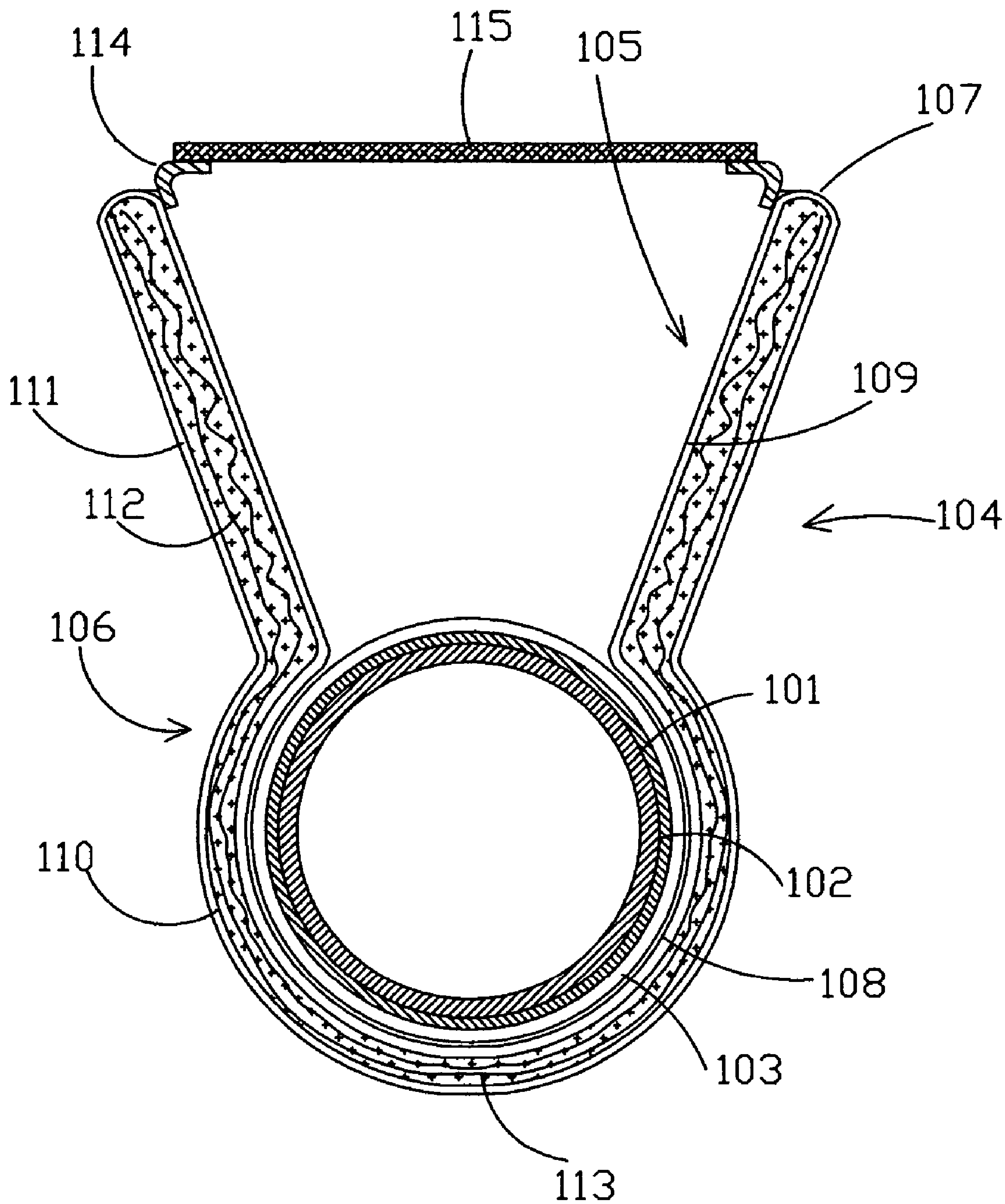


FIG. 1

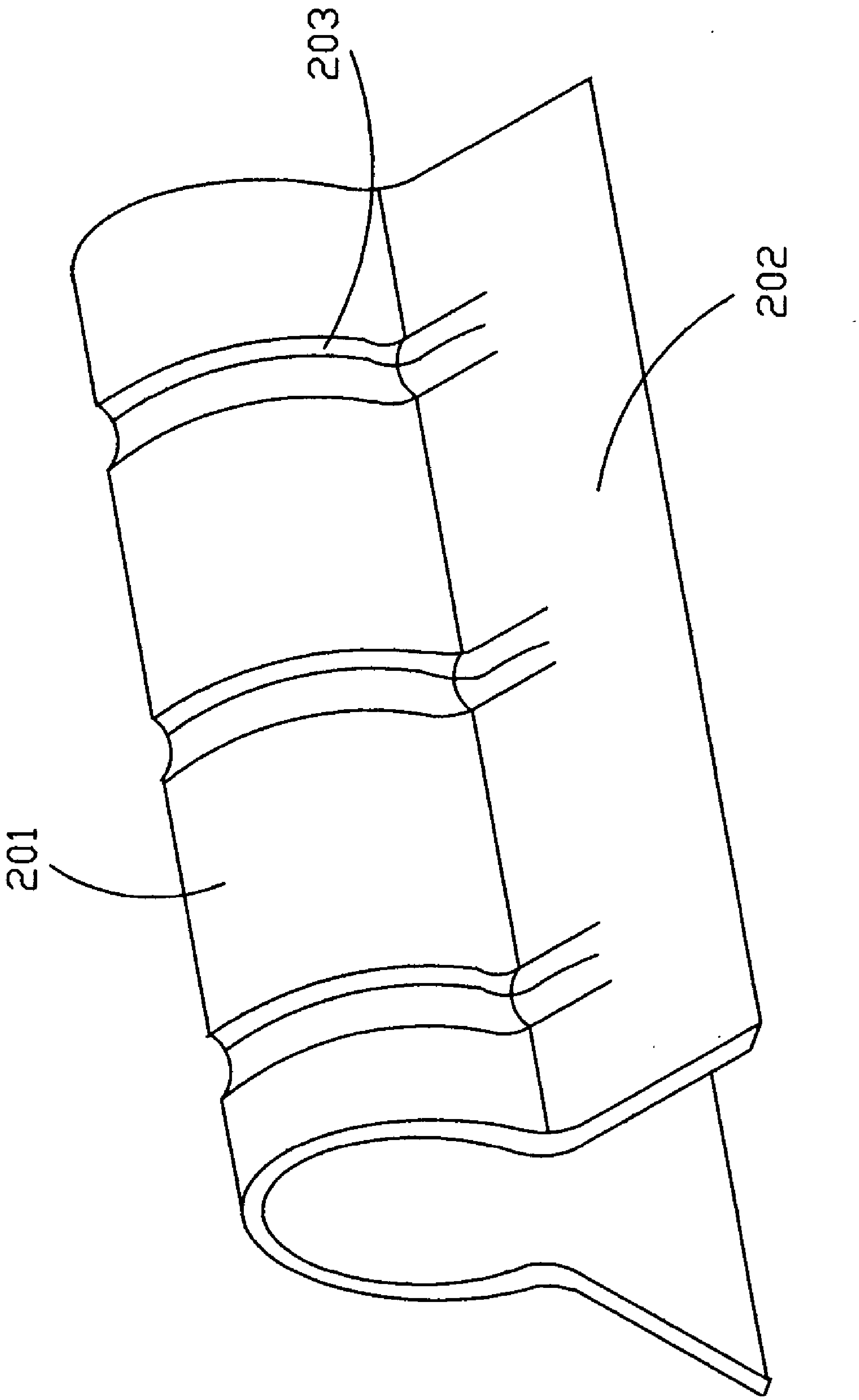


FIG. 2

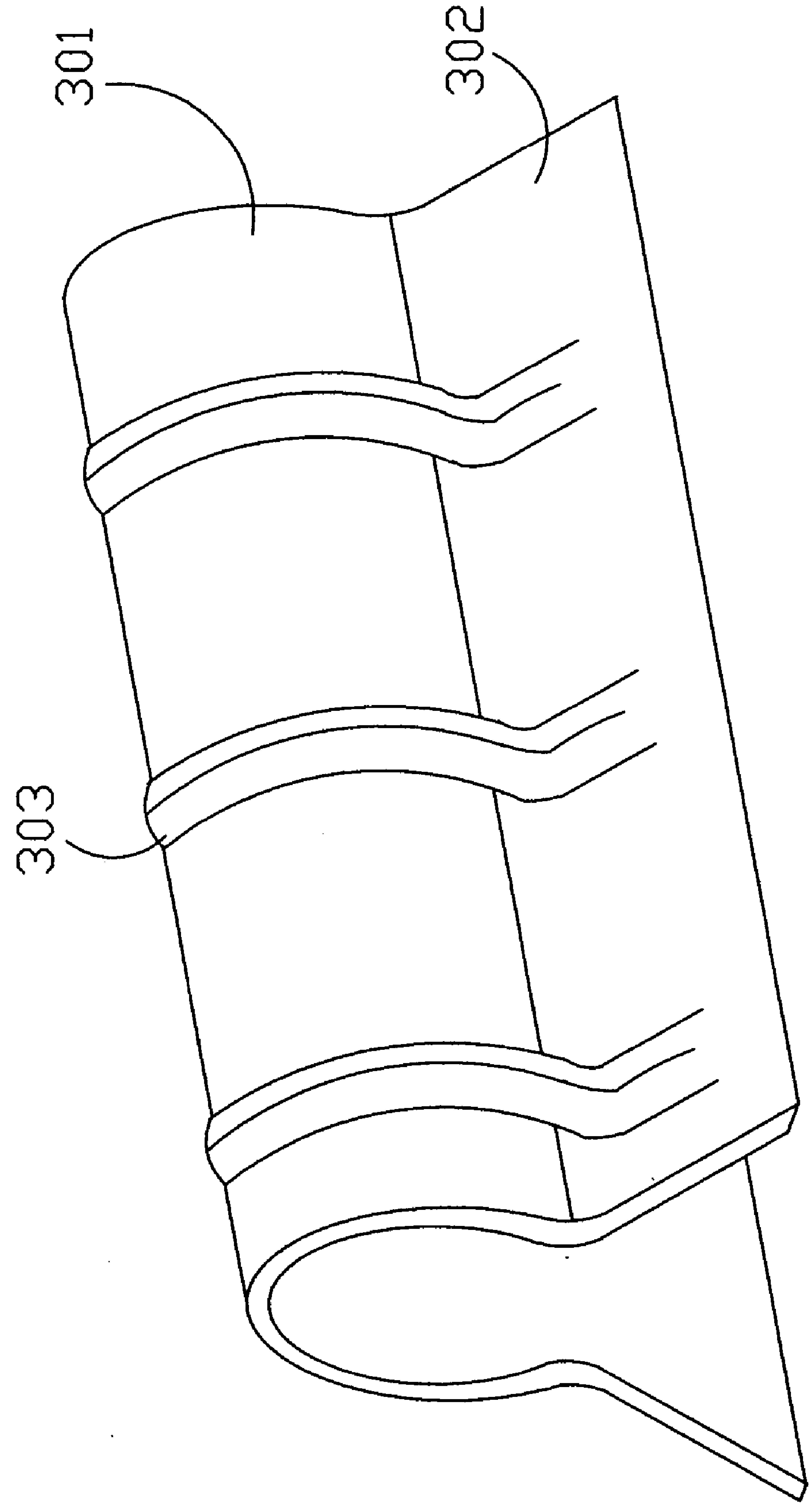


FIG. 3

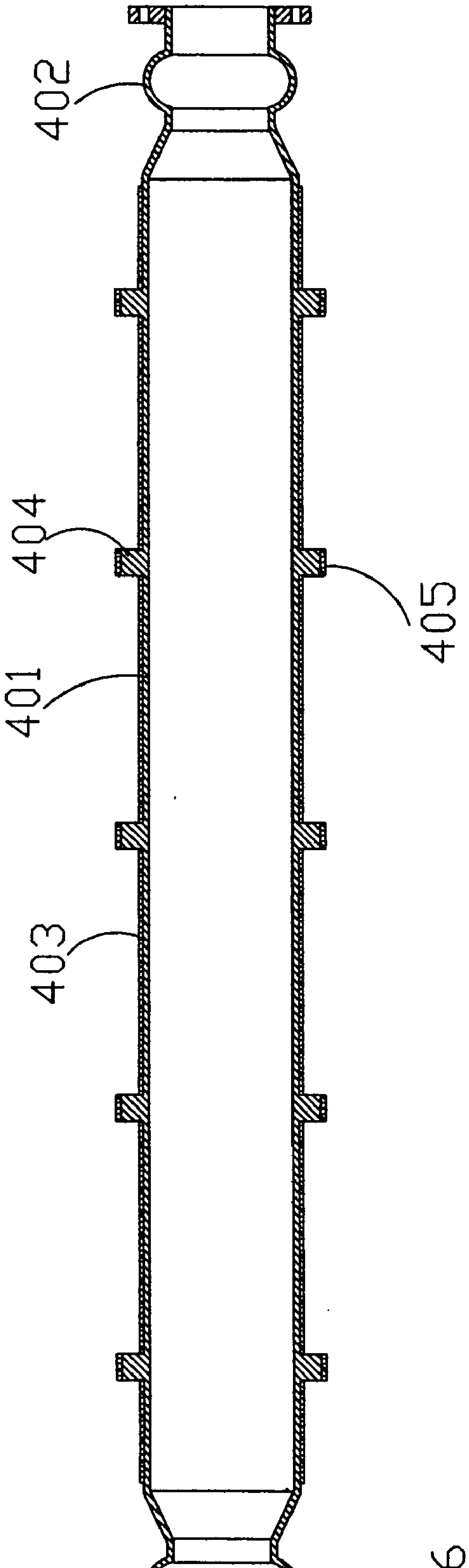


FIG. 4

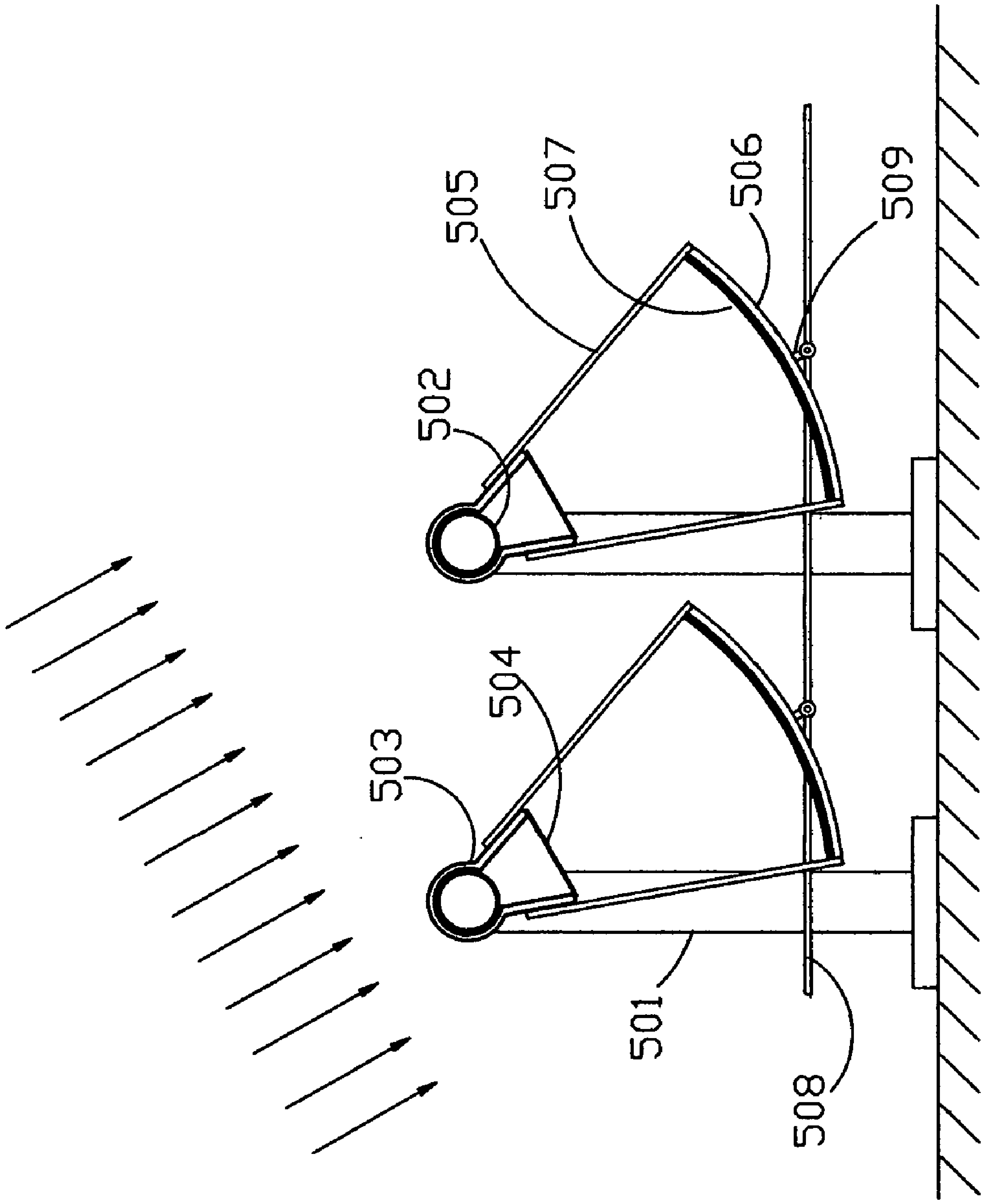


FIG. 5

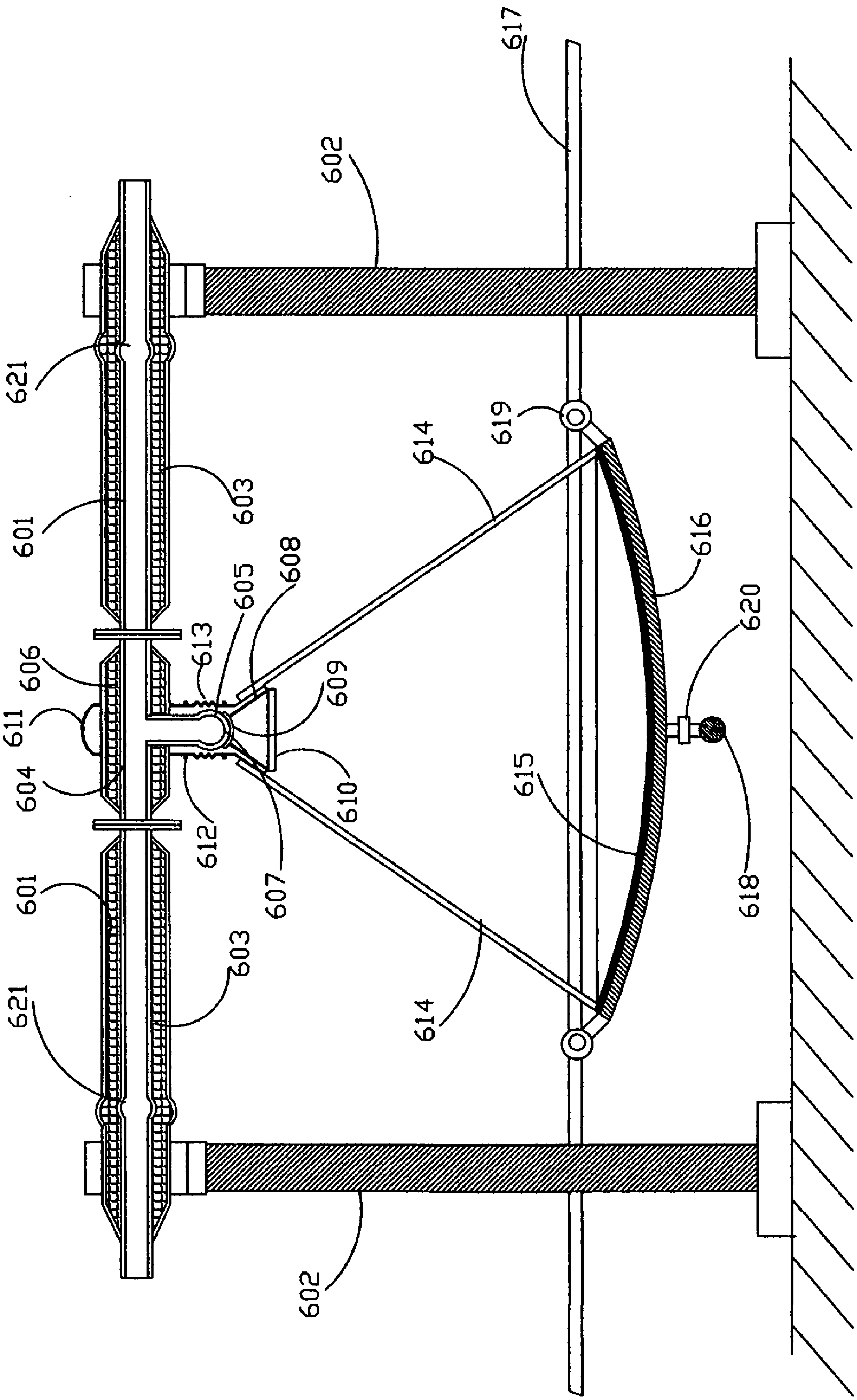

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FIG. 6

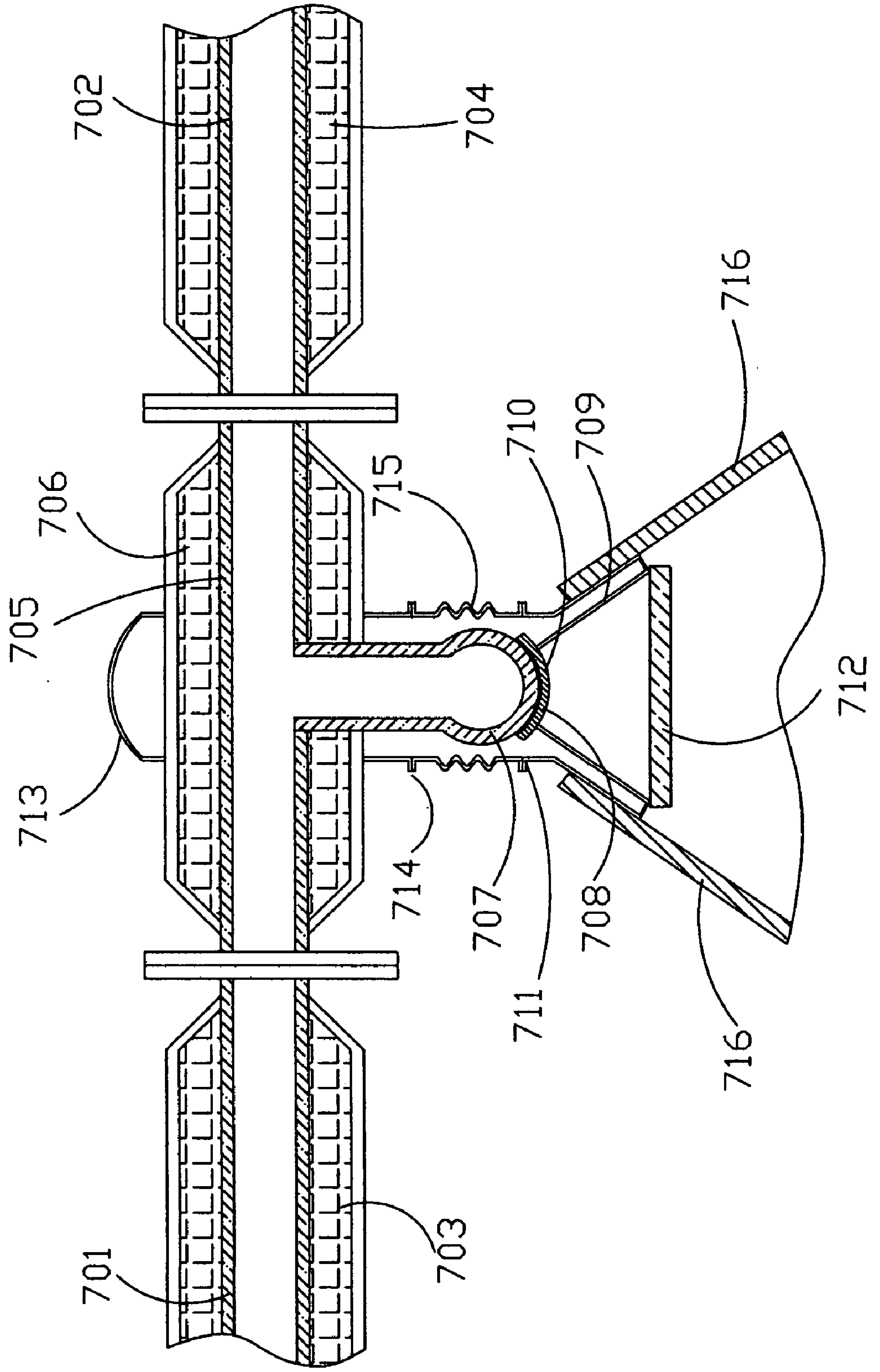
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FIG. 7

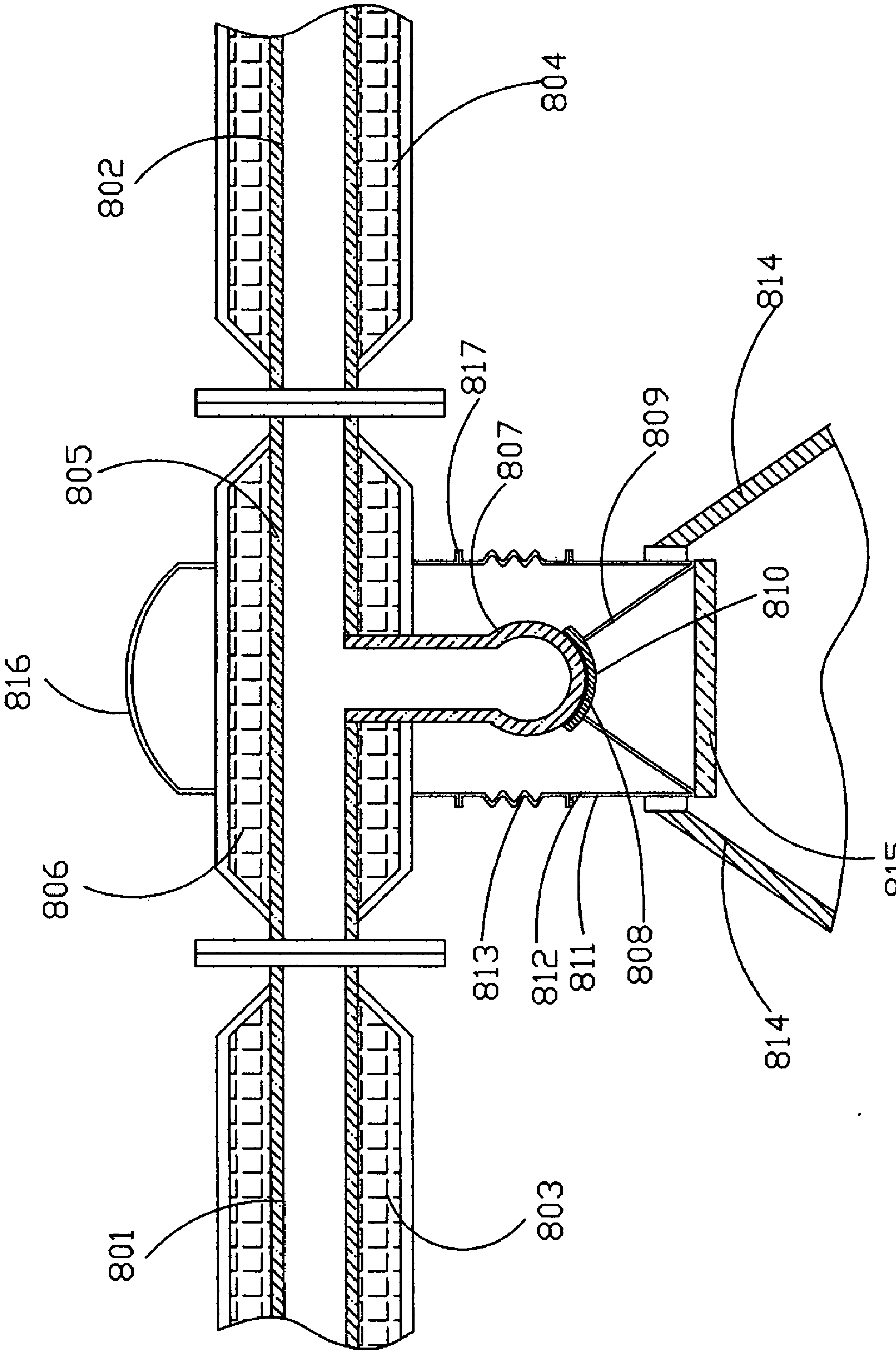
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FIG. 8

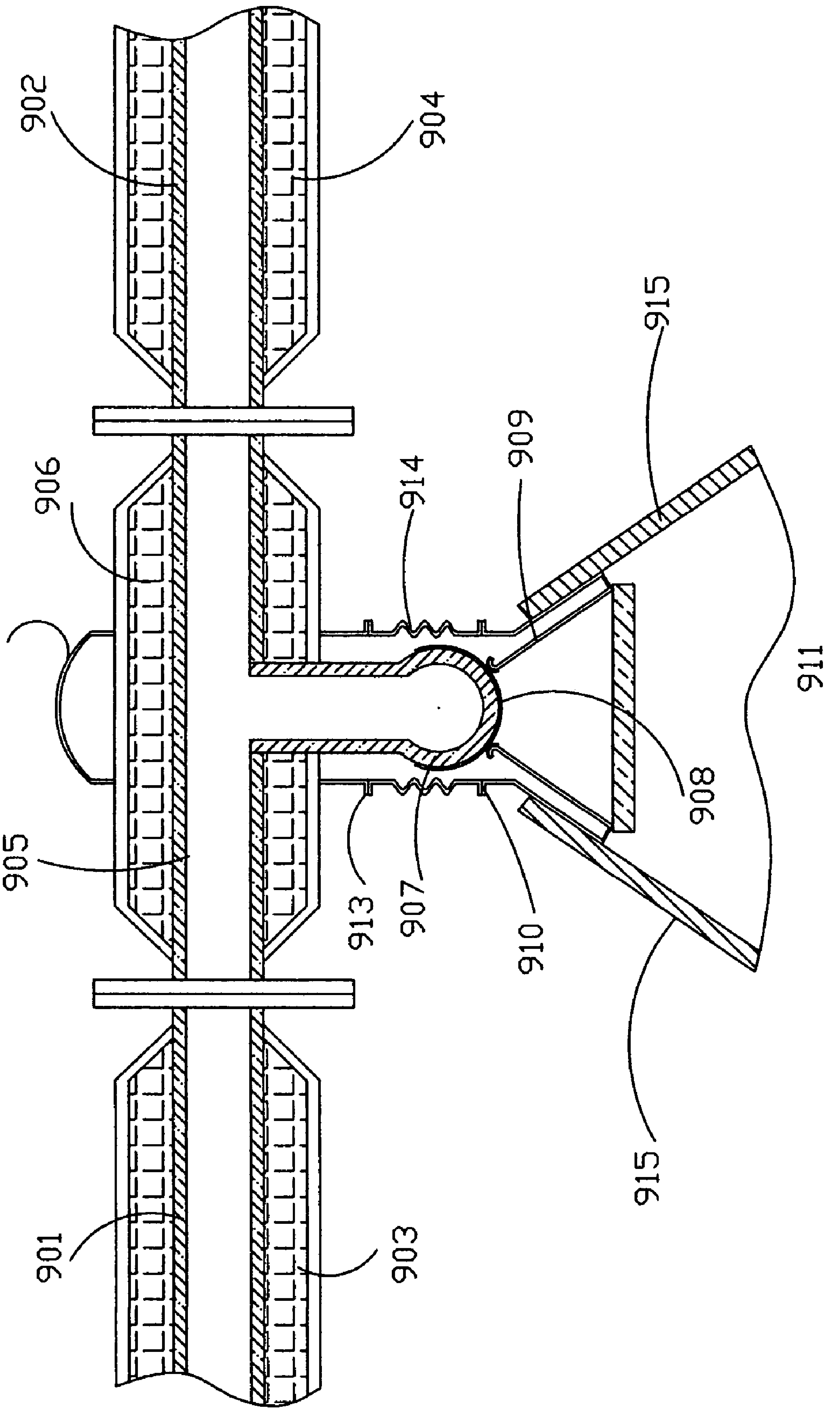

FIG. 9

SOLAR RADIATION MODULAR COLLECTOR

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0001] Not Applicable.

BACKGROUND OF THE INVENTION

[0002] This invention relates to the field of solar radiation collectors intended to convert energy of solar radiation into thermal energy, especially, to the solar collectors, which incorporate single-curvature or compound-curvature concentrators.

[0003] In the case of application of single-curvature parabolic mirrors as the concentrators, the modular solar radiation collector is constructed as combination of an elongated receiver, the single-curvature concentrator and a tracking mechanism, which ensures steady positioning the elongated receiver in the focal zone of the single-curvature concentrator.

[0004] It is known, that such solar collectors allow to achieve temperatures of a working fluid significantly higher than 100° C.; this in turn gives possibility to apply obtained thermal energy in different processes of industry or to convert this thermal energy into electricity with sufficiently high coefficient of performance.

[0005] In the most cases, the single-curvature concentrator is constructed as a trough-wise parabolic mirror or a single-curvature Fresnel lens.

[0006] The elongated receiver is constructed usually as a pipe with an outer coating intended to absorb concentrated and direct solar radiation, and a transparent (glass) elongated envelope positioned around the pipe. The transparent envelope is sealed with the pipe at its ends and the gap between the pipe and the elongated envelope is vacuum-insulated in order to suppress convective losses of thermal energy from the outer surface of the pipe.

[0007] There are some drawbacks, which characterize this construction.

1. Concentrated solar radiation illuminates only a part of the whole surface of the radiation receiving pipe; at the same time, heat loss by radiation occurs from the entire outer surface of this pipe.

2. Sealing the metal pipe of the receiver with the glass envelope is very expensive and sophisticated from the technological point of view.

3. It is impossible to insulate thermally the radiation receiving pipe in a modular manner.

4. Low strength of the glass envelope does not give possibility to apply this glass envelope as a carrying element of the construction of a solar collector.

[0008] Same drawbacks are true for the common solar collectors with application of compound-curvature dish-type concentrators.

BRIEF SUMMARY OF THE INVENTION

[0009] A first version of this invention proposes a solar radiation modular collector with a concentrating unit of the single-curvature type (one-axis sun tracking concentrator) and with a receiver of concentrated solar radiation in the form of a radiation receiving pipe.

[0010] The radiation receiving pipe is provided with a thermal insulation layer in the form of a metal envelope, which can be vacuum-insulated or filled with material with low thermal conductivity. In addition, the internal cavity of this metal envelope can comprise some radiant shields from metal foil with high reflection coefficient in the infrared range. The single-curvature concentrator can be constructed as a parabolic trough-wise reflector, or as a single-curvature Fresnel lens or mirror.

[0011] The metal envelope insulates most of the outer surface of the radiation receiving pipe with significant diminishment of heat losses caused by convection and radiation from this part of the outer surface.

[0012] The metal envelope of the radiation receiving pipe is constructed from two elongated internal and external sections, which are joined by two elongated connection straps and sealed at their ends by face planes.

[0013] The internal elongated section comprises a cylindrical sub-section, which encloses a significant part of the radiation receiving pipe; this cylindrical sub-section is transformed at its longitudinal margins to flat or single-curved strips with a certain angle of convergence with respect to the cylindrical sub-section. In such a way, the cross-section of the internal section is somewhat similar to the vertical cross-section of a jug. The external section encloses the internal one.

[0014] The internal cavity between the internal and external sections of the metal envelope is evacuated in order to suppress convective loss of heat. In addition, this space can be filled with a porous material and/or layers of metal foil in order to diminish heat loss by radiation.

[0015] It is possible to apply filling the internal cavity of the metal envelope with a gas with low thermal conductivity, for example, krypton.

[0016] The gap between the elongated connection straps is glazed in order to diminish heat losses, which occur from the part of the radiation receiving pipe that is not enclosed by the cylindrical sub-section of the internal elongated section.

[0017] It should be noted, that some metal envelopes, which are constructed as it has been described about, could be situated sequentially around one radiation receiving pipe.

[0018] Thermal losses in the proposed construction of the thermal insulation occur mainly by three ways:

[0019] 1. By thermal conductivity of the walls of the metal envelope.

[0020] 2. By radiation from the illuminated surface of the radiation receiving pipe.

[0021] 3. By convection via the internal cavity between the internal flat strips, the glazing and the radiation receiving pipe. The glazing of the internal cavity between the internal flat strips allows to diminish significantly thermal losses occuring by convection. In addition, the glazing may be provided with a transparent coating, which reflects back infrared radiation from the radiation receiving pipe.

[0022] It is clear, that limited thermal conductivity of the walls of the metal envelope causes temperature gradient in it and in turn this can cause deformation of the metal envelope.

[0023] In order to prevent this, the internal and external sections of the metal envelope can be provided with corrugations, which decrease to zero in the vicinity of the connection straps. These corrugations can be directed inwards or outwards with respect to the internal cavity of the metal envelope.

[0024] The outer surface of the external section of the metal envelope can be painted with black or selective paint with very low emittance coefficient in the infrared range; it allows to elevate temperature of the external section of the metal envelope at the expense of the direct solar radiation falling on its surface. It in turn diminishes heat losses caused by thermal conductivity of the metal envelope and by radiation and thermal conductivity via the internal cavity of the metal envelope.

[0025] The proposed receiver of the solar radiation can be rigidly joined by a set of truss struts with the single-curvature concentrator, which should be turned by a tracking mechanism in accordance with the sun motion. In this case, the receiver is turned and moved through turning the single-curvature concentrator.

[0026] However, the mechanical strength of the metal envelope allows to construct the modular solar collector in such a way, that its metal radiation receiving pipe is stationary, and the metal envelope with the single-curvature concentrator, which is rigidly joined with the metal envelope by the set of the truss struts, is turning around the metal radiation receiving pipe by the tracking mechanism. In such a way, the radiation receiving pipe plays the role of a bearing element and an axle.

[0027] The radiation receiving pipe can be provided in this case with a set of ribs in order to prevent contact of the internal surface of the metal envelope with the black or selective coating of the radiation receiving pipe. In addition, the cylindrical surface of these ribs can be provided with an antifriction coating.

[0028] The proposed construction of the thermal insulation of the radiation receiving pipe allows to assemble the solar radiation collector in modular manner without expensive sealing between a glass cylindrical envelope and the radiation receiving pipe.

[0029] Some solar radiation modular collectors can be situated in some rows and the solar radiation modular collectors, which are positioned in the parallel rows, can be provided with common tracking mechanisms.

[0030] The second version of the proposed solar collector is based on application of same technical solutions in the case, when compound-curvature concentrators and, particularly, dish-type parabolic mirrors are used as the concentrators of solar radiation.

[0031] In the case of application of the compound-curvature concentrators in the form of the dish-type mirrors, a module of the proposed system comprises a bearing pipe that is mounted on the vertical posts. A heat transfer medium (working fluid) flows in the bearing pipe.

[0032] The bearing pipe is provided with a layer of thermal insulation.

[0033] Some T-pieces are built into the bearing pipe. The lower branch of each T-piece is sealed by a metal convex spherical cap and a part of the outer surface of the T-piece is covered with a layer of thermal insulation.

[0034] In addition, there is a solar radiation receiving member, which is constructed from a dish-type plate and a double-wall funnel.

[0035] The upper side of the dish-type plate has the concave surface in the form of a spherical segment with the radius almost identical to that of the metal convex spherical cap. In such a way, this pair: the spherical cap of the T-piece and the concave surface of the dish-type plate present a spherical joint. The lower surface of the dish-type plate is covered with a layer of a solar radiation absorption coating.

[0036] The upper surface of the dish-type plate and the outer surface of the metal convex spherical cap can be provided with antifriction coatings.

[0037] The upper edge of the internal wall of the double-wall funnel is joined with the edge of the dish-type plate and the edge of its outer wall is provided with a flange.

[0038] The distal (lower) aperture of the double-wall funnel can be glazed in order to diminish heat losses via its internal cavity. In addition, this glazing can be provided with a transparent coating, which reflects back infrared radiation from the layer of the solar radiation absorption coating of the dish-type plate.

[0039] The internal surface of the internal wall of the double-wall funnel can be provided with the property of high reflectivity for solar radiation; in such a way, this internal wall plays a role of an additional non-imaging concentrator of the solar radiation.

[0040] There is a bearing housing with a split lower flange and two longitudinal slots; this housing is mounted on the thermal insulation of the T-piece.

[0041] The open sections of the longitudinal slots are closed by a clamp.

[0042] The flanges of the bearing housing and the outer wall of the double-wall funnel are joined by a flexible joint, which plays at the same time a role of a thermal insulator.

[0043] The outer wall of the double-wall funnel serves at the same time for mounting truss struts, which serve in turn for installation of a dish-type concentrating mirror with its frame.

[0044] The frame of the dish-type mirror is joined through cylindrical hinges with tracking rods.

[0045] The internal cavity between the walls of the double-wall funnel and between the flexible joint and the lower branch of the T-piece can be filled with thermo-insulating material with low thermal conductivity.

[0046] It should be noted that heat transfer from the internal surface of the spherical cap to the working medium is performed mainly by natural convection, conduction and boiling. In order to diminish temperature drop between this internal surface and the working medium, the internal surface of the spherical cap may be provided with fins and/or a porous coating from metal powder; this porous coating has open porosity.

[0047] It is possible to apply a funnel with a single wall instead of the aforementioned double-wall funnel; in this case the lower edge of the funnel is joined with a connecting branch with a flange; this connecting branch is joined in turn with the lower flange of the flexible joint. The truss struts are joined in this case with the connecting branch.

[0048] In addition, it is possible to obviate application of the dish-type plate. The outer surface of the metal convex spherical cap is provided in this case with a radiation absorption coating. This coating must be stable against friction with the upper edge of the aforementioned double- or single-wall funnel.

[0049] A solar radiation collector can be assembled from some solar radiation modular collectors, which are described above; these some solar radiation modular collectors are placed in the form of parallel rows and bearing pipes are interconnected in series in each row.

[0050] The solar radiation modular collectors, which are positioned in parallel and/or belong to one set of interconnected in series bearing pipes, have the common tracking units.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0051] **FIG. 1** is a transverse cross-section of a receiver of a concentrated solar radiation collector module with a concentrating single-curvature unit.

[0052] **FIG. 2** is an isometric view of an internal section of a metal envelope of the receiver, which is shown in **FIG. 1**, with corrugations directed inwards.

[0053] **FIG. 3** is an isometric view of an external section of the metal envelope of the receiver, which is shown in **FIG. 1**, with corrugations directed outwards.

[0054] **FIG. 4** is an axial cross-section of a radiation receiving pipe of the receiver, which is shown in **FIG. 1**.

[0055] **FIG. 5** is a transverse cross-section of the solar radiation collector modules with concentrating single-curvature units and with some elements of a tracking mechanism.

[0056] **FIG. 6** is a longitudinal cross-section of the solar radiation collector module with a concentrating compound-curvature unit and with some elements of a tracking mechanism.

[0057] **FIG. 7** is a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a double-wall funnel and a dish-type radiation absorption plate.

[0058] **FIG. 8** is a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a single-wall funnel and a dish-type radiation absorption plate.

[0059] **FIG. 9** is a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a metal convex spherical cap for absorption of concentrated solar radiation.

DETAILED DESCRIPTION OF THE INVENTION

[0060] **FIG. 1** shows the transverse cross-section of the receiver of concentrated solar radiation with a concentrating single-curvature unit.

[0061] It comprises: a radiation receiving pipe **101** with a selective coating **102** of its outer surface and low circular ribs **103**, and a metal envelope **104**.

[0062] This metal envelope includes an internal elongated section **105** and an external elongated section **106**, which are joined by two elongated connection straps **107** and sealed at their ends by face planes; the internal elongated section **105** comprises in turn a cylindrical sub-section **108**, which encloses a significant part of the radiation receiving pipe **101**; this cylindrical sub-section **108** is transformed at its longitudinal margins to flat strips **109** with a certain angle of convergence with respect to the cylindrical sub-section **108**.

[0063] The external elongated section **106** comprises a cylindrical sub-section **110**, which encloses the cylindrical sub-section **108**; this cylindrical sub-section **110** is transformed at its longitudinal margins to flat strips **111** with the same angle of convergence as the flat strips **109**.

[0064] Two elongated connection straps **112** join the flat strips **109** and **111**.

[0065] The internal space between the internal and external sections is evacuated in order to suppress convective losses of heat. In addition, this space can be filled with a porous filler **113**.

[0066] In addition, radiation shields in the form of metal foils **114** are situated in the internal cavity of the metal envelope **104**.

[0067] The flat strips **109** are provided with longitudinal clamps **115**, which serve for fastening glazing **116**.

[0068] **FIG. 2** demonstrates the isometric view of the internal section of the metal envelope with corrugations directed inwards.

[0069] It comprises a cylindrical sub-section **201**, which is transformed at its longitudinal margins to flat strips **202**.

[0070] The cylindrical sub-section **201** and the flat strips **202** are provided with corrugations **203**, which decrease to zero at their lower margins, these corrugations **203** are directed inwards with respect to the cylindrical sub-section **201**.

[0071] **FIG. 3** is an isometric view of an external section of the metal envelope with corrugations directed outwards.

[0072] It comprises a cylindrical sub-section **301**, which is transformed at its longitudinal margins to flat strips **302**.

[0073] The cylindrical sub-section **301** and the flat strips **302** are provided with corrugations **303**, which decrease to zero at their lower margins, these corrugations **303** are directed outwards with respect to the cylindrical sub-section **301**.

[0074] **FIG. 4** demonstrates an axial cross-section of the radiation receiving pipe. It comprises a metal pipe **401** that is provided with two bellows **402** at its extreme sections, these bellows are intended to compensate thermal expansion of the metal pipe **401**. The outer surface of the metal pipe

401 is provided with a selective coating **403**. It should be noted, that this selective coating could cover only the part of the outer surface, which can be irradiated by the concentrated solar radiation. In addition, the metal pipe **401** is provided with low ribs **404**, which prevent immediate contact of the selective coating **403** with the surface of the internal section of the metal envelope in the process of its turning around the metal pipe **401**. The cylindrical surfaces of the low ribs are provided with antifriction coatings **405**.

[**0075**] Flanges **406** are installed on the ends of the metal pipe **401**.

[**0076**] **FIG. 5** is a transverse cross-section of two solar radiation collectors positioned in parallel with a common tracking rod and with a concentrating single-curvature units.

[**0077**] It shows posts **501** with pipes **502** installed on their upper sections. A metal envelope **503**, which is provided with glazing **504**, is situated on pipe **502** and can rotate around this pipe. Truss struts **505** serve for fastening frames **506**, which in turn serve for installation of parabolic trough-wise mirrors **507**. A common tracking rod **508** is joined by hinged units **509** with frames **506**. This allows to perform tracking after the sun motion by a common tracking unit.

[**0078**] **FIG. 6** shows a longitudinal cross-section of the solar radiation collector module with a concentrating compound-curvature unit and with some elements of a tracking mechanism.

[**0079**] It comprises bearing pipes **601** with expansion units **621**, which are mounted on vertical posts **602**. A working medium flows in the bearing pipes **601**. The bearing pipes **601** are provided with layers **603** of a thermal insulation.

[**0080**] T-piece **604** is built into the bearing pipes **601**. The lower branch of T-piece **604** is sealed by a metal convex spherical cap **605**.

[**0081**] T-piece **604** is covered with layer **606** of a thermal insulation.

[**0082**] In addition, there is a solar radiation receiving member, which constructed from a dish-type plate **607** and a double-wall funnel **608**.

[**0083**] The upper side of the dish-type plate **607** has the concave surface in the form of a spherical segment with the radius almost identical to that of the metal convex spherical cap **605**. In such a way, this pair: the metal convex spherical cap **605** and the concave surface of the dish-type plate **607** present a spherical joint.

[**0084**] The lower surface of the dish-type plate **607** is covered with layer **608** of a solar radiation absorption coating.

[**0085**] The upper edge of the internal wall of the double-wall funnel **608** is joined with the edge of the dish-type plate **607** and the edge of its outer wall is provided with flange **609**.

[**0086**] The distal (lower) aperture of the double-wall funnel **608** is glazed by glazing **610** in order to diminish heat losses via its internal cavity.

[**0087**] There is a bearing housing **611** with a split lower flange **612** and two longitudinal slots; this bearing housing **611** is mounted on the thermal insulation **606** of T-piece **604**.

[**0088**] The open sections of the longitudinal slots of the bearing housing **611** are closed by a clamp. The flanges **612** and **609** of the bearing housing **611** and of the outer wall of the double-wall funnel **608** are joined by a flexible joint **613**, which plays at the same time a role of a thermal insulator.

[**0089**] The outer wall of the double-wall funnel **608** serves at the same time for mounting truss struts **614**, which in turn serve for installation of a dish-type concentrating mirror **615** with its frame **616**.

[**0090**] Frame **616** of the dish-type concentrating mirror **615** is joined through cylindrical hinges **619** and **620** with tracking rods **617** and **618**.

[**0091**] **FIG. 7** demonstrates a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a double-wall funnel and a dish-type radiation absorption plate.

[**0092**] It comprises: bearing pipes **701** and **702** with insulting layers **703** and **704**; T-piece **705** with an insulating layer **706**, the lower branch of this T-piece **705** is sealed by a metal convex spherical cap **707**. In addition, there is a solar radiation receiving member, which is constructed from a dish-type plate **708** and a double-wall funnel **709**.

[**0093**] The upper side of the dish-type plate **708** has the concave surface in the form of a spherical segment with the radius almost identical to that of the metal convex spherical cap **707**. In such a way, this pair: the metal convex spherical cap **707** of T-piece **705** and the concave surface of the dish-type plate **708** present a spherical joint.

[**0094**] The lower surface of the dish-type plate **708** is covered with layer **710** of solar radiation absorption coating.

[**0095**] The upper edge of the internal wall of the double-wall funnel **709** is joined with the edge of the dish-type plate **708** and the edge of its outer wall is provided with flange **711**.

[**0096**] The distal (lower) aperture of the double-wall funnel **709** is glazed with glazing **712**.

[**0097**] There is a bearing housing **713** with a split lower flange **714** and two longitudinal slots; this bearing housing **713** is mounted on the thermal insulation **706** of T-piece **705**.

[**0098**] Flanges **714** and **711** of the bearing housing **713** and of the outer wall of the double-wall funnel **709** are joined by a flexible joint **715**, which plays at the same time a role of a thermal insulator.

[**0099**] The outer wall of the double-wall funnel **709** serves at the same time for mounting truss struts **716**, which in turn serve for installation of a dish-type concentrating mirror with its frame.

[**0100**] **FIG. 8** shows a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a single-wall funnel and a dish-type radiation absorption plate.

[**0101**] It comprises: bearing pipes **801** and **802** with insulting layers **803** and **804**; T-piece **805** with an insulating layer **806**, the lower branch of T-piece **805** is sealed by a metal convex spherical cap **807**. In addition, there is a solar radiation receiving member, which constructed from a dish-type plate **808** and a single-wall funnel **809**.

[0102] The upper side of the dish-type plate **808** has the concave surface in the form of a spherical segment with the radius almost identical to that of the metal convex spherical cap **807**. In such a way, this pair: the metal convex spherical cap **807** of the T-piece and the concave surface of the dish-type plate **808** present a spherical joint.

[0103] The lower surface of the dish-type plate **808** is covered with layer **810** of a solar radiation absorption coating.

[0104] The lower edge of the single-wall funnel **809** is joined with a connecting branch **811** with flange **812**, which is joined in turn with the lower flange of a flexible joint **813**. Truss struts **814** are joined in this case with the connecting branch **811**, these truss struts serve in turn for installation of a dish-type concentrating mirror with its frame.

[0105] The distal (lower) aperture of the single-wall funnel **809** is glazed with glazing **815**.

[0106] There is a bearing housing **816** with a split lower flange **817** and two longitudinal slots; this bearing housing **816** is mounted on the thermal insulation **806**. The split lower flange **817** of the bearing housing **816** is joined with the flexible joint **813**, which plays at the same time a role of a thermal insulator serving in turn for installation of a dish-type concentrating mirror with its frame.

[0107] **FIG. 9** is a cross-section of a combined unit: a T-piece—solar radiation receiver with application of a metal convex spherical cap for absorption of concentrated solar radiation.

[0108] It comprises: bearing pipes **901** and **902** with insulting layers **903** and **904**; T-piece **905** with an insulating layer **906**, the lower branch of T-piece **905** is sealed by a metal convex spherical cap **907**.

[0109] The outer surface of the metal convex spherical cap **907** is provided with a radiation absorption coating **908**.

[0110] There is a double-wall funnel **909**; the upper edge of this double-wall funnel is in immediate contact with the radiation absorption coating **908** of the metal convex spherical cap **907**, and the double wall funnel **909** can be turned in two directions around this metal convex spherical cap **907**.

[0111] In such a way, this pair: the metal convex spherical cap **907** of T-piece **905** and the double-wall funnel **909** present a spherical joint.

[0112] The outer edge of the outer wall of the double-wall funnel **909** is provided with flange **910**.

[0113] The distal (lower) aperture of the double-wall funnel **909** is glazed with glazing **911**.

[0114] There is a bearing housing **912** with a split lower flange **913** and two longitudinal slots; this bearing housing **912** is mounted on the thermal insulation **906** of T-piece **905**.

[0115] Flanges **913** and **910** of the bearing housing **912** and of the outer wall of the double-wall funnel **909** are joined by a flexible joint **914**, which plays at the same time a role of a thermal insulator. The outer wall of the double-wall funnel **909** serves at the same time for mounting truss struts **915**, which serve in turn for installation of a dish-type concentrating mirror with its frame.

[0116] Other embodiments and configurations may be devised without departing from the spirit of the invention and the scope of appended claims.

What is claimed is:

1. A solar radiation modular collector consisting of following units:

a concentrating unit of the single-curvature type (one-axis sun tracking concentrator);

a receiver of concentrated solar radiation, said receiver comprises: a metal pipe with an inlet and outlet connections, flexible sections at the extreme sections of said metal pipe for compensation of its thermal expansion, a black or selective coating of the outer surface of said metal pipe; joining means at the ends of said metal pipe; a thermal insulation intended to insulate thermally a significant part of said metal pipe; said thermal insulation in the form of a metal envelope has a vacuum-insulated internal cavity; said metal envelope comprises elongated internal and external sections, which are joined by two elongated connection straps and sealed at their ends by face planes; said internal elongated section comprises a cylindrical sub-section, which encloses a significant part of said metal pipe; said cylindrical sub-section is transformed at its longitudinal margins to flat or single-curved strips with a certain angle of convergence with respect to said cylindrical sub-section; said elongated external section encloses said metal pipe; the internal cavity between said elongated internal and external sections is evacuated in order to suppress convective losses of heat from said metal pipe; said internal cavity is filled with a porous material and/or layers of metal foil in order to diminish heat losses by radiation from said metal pipe; the gap between the distal longitudinal margins of said flat or single-curved strips is glazed by a glazing; said internal and external sections of said metal envelope are provided with corrugations, which decrease to zero in the vicinity of said connection straps; said receiver is positioned in the zone of the focal line of said single-curvature concentrator;

a set of truss struts joining said concentrating unit with said metal envelope;

a tracking unit, which ensures tracking the sun by said concentrating unit;

an auxiliary means for installation of said concentrating unit, said metal pipe and said metal envelope.

2. A solar radiation modular collector as claimed in claim 1, wherein said metal pipe is provided at its extreme sections with flexible sections in order to compensate its thermal expansion.

3. A solar radiation modular collector as claimed in claim 1, wherein said metal pipe is provided with a set of low circular ribs in order to prevent immediate contact of said black or selective coating with the inner surface of said elongated internal section.

4. A solar radiation modular collector as claimed in claim 3, wherein the cylindrical surfaces of said circular ribs are provided with an antifriction coating.

5. A solar radiation modular collector as claimed in claim 1, wherein the ends of said metal pipe are provided with flanges.

6. A solar radiation modular collector as claimed in claim 1, wherein said metal pipe is installed on two posts, which serve as said auxiliary means, and said metal envelope can rotate around said metal pipe.

7. A solar radiation modular collector as claimed in claim 1, wherein the outer surface of said external section of said metal envelope is provided with a selective coating, which absorbs concentrated solar radiation.

8. A solar radiation modular collector as claimed in claim 1, wherein reflecting shields from metal foil are positioned in said internal cavity of said metal envelope.

9. A solar radiation modular collector as claimed in claim 8, wherein said internal cavity of said metal envelope is filled with gas.

10. A solar radiation modular collector as claimed in claim 9, wherein said gas has low thermal conductivity.

11. A solar radiation modular collector as claimed in claim 1, wherein said internal cavity is filled with powdered solid material.

12. A solar radiation modular collector as claimed in claim 1, wherein the extreme sections of said metal pipe are provided with threads instead of said flanges.

13. A solar radiation modular collector as claimed in claim 1, wherein there are some said metal envelopes situated around one said metal pipe, and, correspondingly, there are some said concentrating units, which are joined with said metal envelopes.

14. A solar radiation collector assembled from some said solar radiation modular collectors as it is claimed in claim 1; said some solar radiation modular collectors are placed in the form of parallel rows and said metal pipes are interconnected in series in each said row.

15. A solar radiation collector as claimed in claim 14, wherein said solar radiation modular collectors, which are positioned in parallel, have common tracking units.

16. A solar radiation modular collector consisting of following units and details:

a concentrating unit of the compound-curvature type with a frame;

a bearing pipe with an inlet and outlet connections and flexible joints at its extreme sections for compensation of its thermal expansion; said bearing pipe is intended for transport of heat by a working medium flowing in it; said bearing pipe is provided with a thermal insulation layer;

posts for mounting said bearing pipe;

some T-pieces, which are built into said bearing pipe; the lower branch of each said T-piece is sealed by a metal convex spherical cap and a part of its outer surface of the T-piece is covered with a thermal insulation layer;

a solar radiation receiving unit, which is constructed from a dish-type plate and a double-wall funnel; the upper side of said dish-type plate has the concave surface in the form of a spherical segment with the radius almost identical to that of said metal convex spherical cap; in such a way, this pair: said spherical cap of the T-piece and said concave surface of said dish-type plate present a spherical joint; the lower surface of said dish-type plate is covered with a layer of solar radiation absorption coating; the upper edge of the internal wall of said double-wall funnel is joined with the edge of said dish-type plate and the edge of its outer wall is provided with a flange;

a glazing of the distal (lower) aperture of said double-wall funnel;

a bearing housing with a split lower flange and two longitudinal slots;

said bearing housing is mounted on said thermal insulation layer of said T-piece;

a clamp, which closes the open sections of said bearing housing;

a flexible joint that joins said split lower flange of said bearing housing and said flange of said double-wall funnel;

a tracking unit, which ensures tracking the sun by said concentrating unit of the compound-curvature type; said tracking unit includes tracking rods, which are joined by hinges with said frame.

17. A solar radiation modular collector as claimed in claim 16, wherein a funnel with a single wall is applied instead of said double-wall funnel; the lower edge of said single-wall funnel is joined with a connecting branch with a flange, which is joined in turn with the lower flange of said flexible joint; said truss struts are joined in this case with said connecting branch.

18. A solar radiation modular collector as claimed in claim 16, wherein said dish-type plate is not used and the outer surface of said metal convex spherical cap is provided with a radiation absorption coating; said radiation absorption coating is stable against friction with the upper edge of said double-wall funnel.

19. A solar radiation modular collector as claimed in claim 16, wherein the internal surface of said internal wall of said double-wall funnel has a high value of light reflection coefficient.

20. A solar radiation collector assembled from some said solar radiation modular collectors as it is claimed in claim 16; said some solar radiation modular collectors are placed in the form of parallel rows; said bearing pipes are interconnected in series in each said row; said solar radiation modular collectors, which are positioned in parallel and/or belong to said one set of interconnected in series said bearing pipes, have common tracking units.

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