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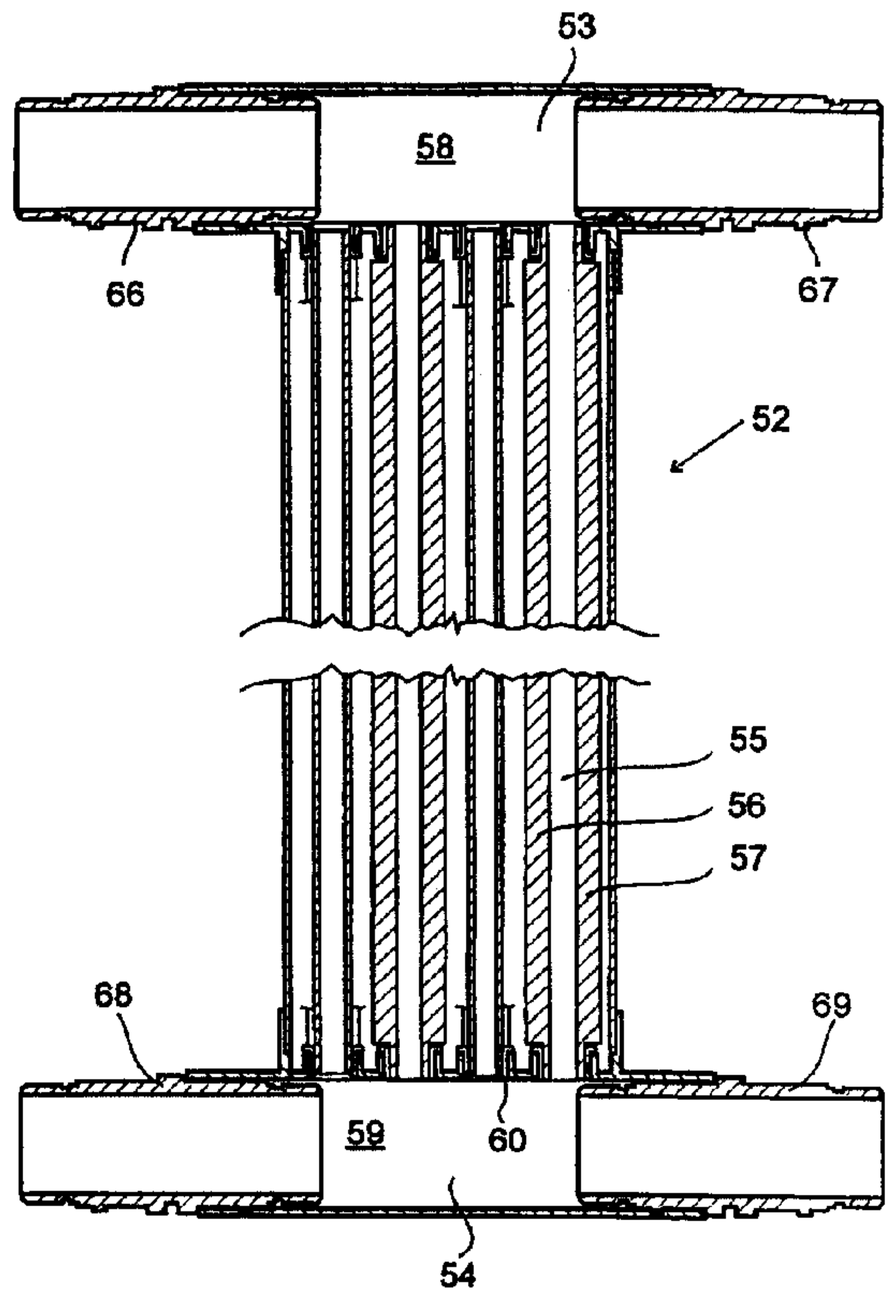
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(30) 1997/04/24 (PO 6508) AU

(54) **DISPOSITIF D'ABSORPTION D'ENERGIE SOLAIRE**
(54) **SOLAR ABSORBERS**



(57) L'invention a trait à un panneau d'absorption de l'énergie solaire destiné à chauffer un fluide. Ledit panneau regroupe une pluralité de sous-ensembles (52) d'absorption de l'énergie solaire, chaque sous-ensemble comportant une pluralité de tubes absorbants (55) entourés par une enveloppe (29) qui transmet l'énergie solaire. Chaque tube s'étend entre un collecteur supérieur et un collecteur inférieur (53, 54). Des

(57) A solar energy absorber panel for heating a fluid, joins a plurality of solar absorber subassemblies (52), each subassembly includes a plurality of absorber tubes (55) surrounded by a solar energy transmissive enclosure (29), said tubes extending between an upper and a lower manifold (53, 54). Adjacent subassemblies are joined by the respective upper and lower manifold ends by connection means (10) that utilise counter

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sous-ensembles adjacents sont regroupés par les extrémités respectives des collecteurs supérieur et inférieur au moyen d'un élément de liaison (10) qui utilise un mécanisme à vis contrarotatif et un joint torique. L'enveloppe (29) qui transmet l'énergie solaire est un élément de protection extrudé, d'une seule pièce, doté d'un canal situé entre des faces plates qui s'étendent de manière transversale et qui présentent des nervures opposées (32) destinées à fixer les tubes absorbants. Les collecteurs supérieur et inférieur (53, 54) présentent des buses, qui s'étendent vers l'extérieur (23) en vue de venir au contact desdits tubes absorbants (55), et une collerette (24) qui est fixée aux tubes par des éléments de blocage tels que des chevilles.

rotating screw mechanism and O-ring seal. The solar energy transmissive enclosure (29) is a single piece extruded glazing means with a passage between transversely extended flat faces with opposed ribs (32) to bracket absorber tubes. The upper and lower manifolds (53, 54) have outwardly extending spouts (23) to engage with the absorber tubes (55) and a skirt (24) joined thereto by locking means such as pins.

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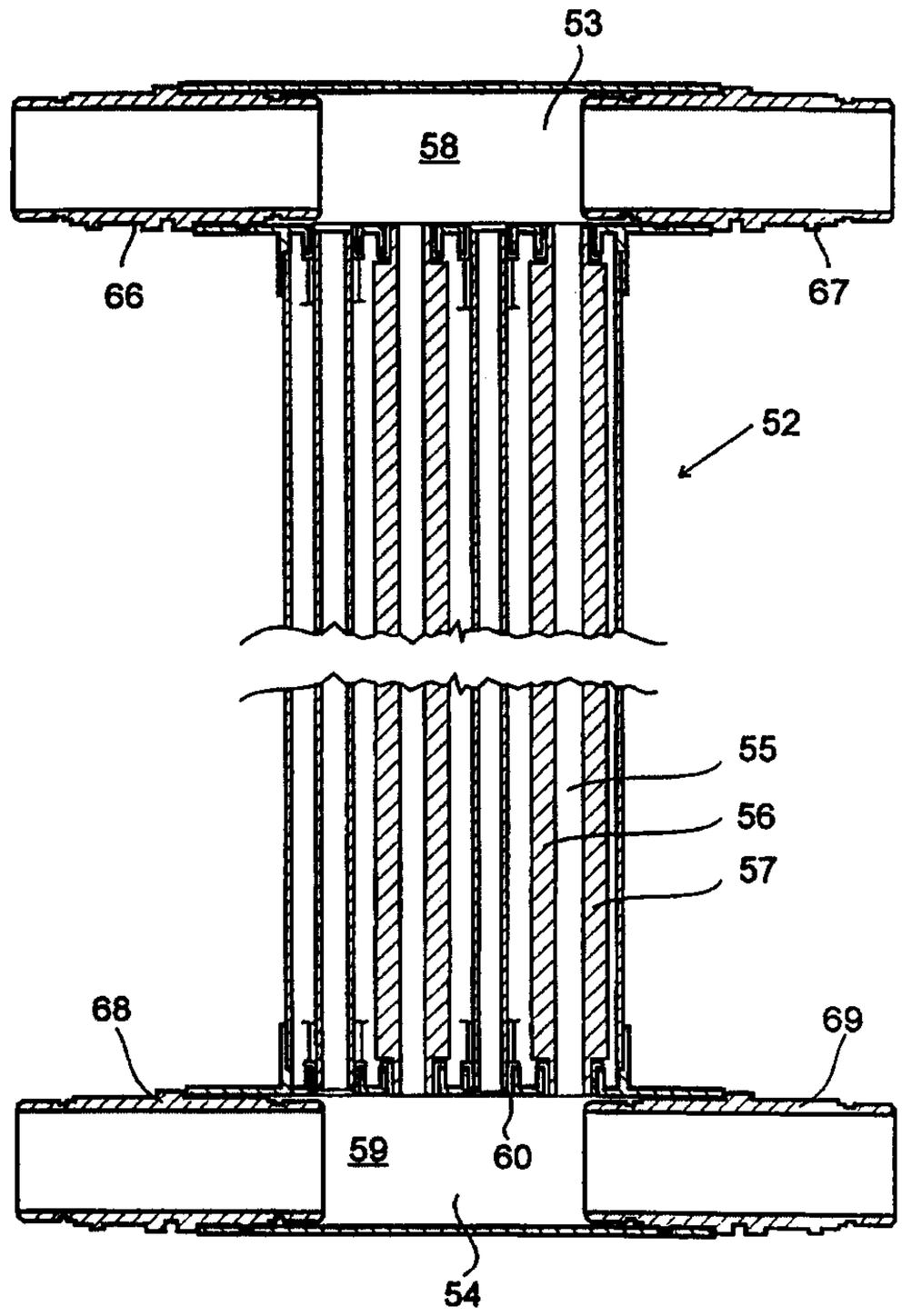
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(57) Abstract

A solar energy absorber panel for heating a fluid, joins a plurality of solar absorber subassemblies (52), each subassembly includes a plurality of absorber tubes (55) surrounded by a solar energy transmissive enclosure (29), said tubes extending between an upper and a lower manifold (53, 54). Adjacent subassemblies are joined by the respective upper and lower manifold ends by connection means (10) that utilise counter rotating screw mechanism and O–ring seal. The solar energy transmissive enclosure (29) is a single piece extruded glazing means with a passage between transversely extended flat faces with opposed ribs (32) to bracket absorber tubes. The upper and lower manifolds (53, 54) have outwardly extending spouts (23) to engage with the absorber tubes (55) and a skirt (24) joined thereto by locking means such as pins.



"SOLAR ABSORBERS"

TECHNICAL FIELD.

THIS INVENTION relates to heating and in particular to improvements in assemblies of solar absorbers, typically arranged in the form of a so called solar fence, for the heating of swimming pools and the like, generally of the type seen in prior Australian Patent Number 645887 to the same applicant.

BACKGROUND ART.

Australian Patent Number 645887 describes a solar fence formed with solar energy absorber panels which are comprised of an array of solar absorber subassemblies, joined together to form respective panels, which panels are then interconnected to establish a fence or the like, for the collection of heat. The solar energy absorber panels may be supported on suitable posts to establish a fence or barrier. Each solar absorber subassembly of the aforesaid panels is constructed of a plurality of interconnected parts. Each utilises a plurality of spaced absorber tubes, connected in parallel in said subassemblies, being extended between upper and lower manifolds by which to direct the flow of a liquid to be heated through the absorber tubes, the subassemblies being joined via interconnection of the upper and lower manifolds, for flow of fluid to and from said panels, and,

finally, by interconnection of the fence panels, to and from the fence, or the like. In the prior patent the upper and lower manifolds were provided with respective male and female ends by which to be interconnected to form the respective solar absorber subassemblies, the respective solar energy absorber panels, and said panels into a solar fence.

Whilst the device described in the above prior specification is adequate to achieve its object, there are points at which improvements can be made.

DISCLOSURE OF THE INVENTION.

It is an object of the present invention to provide improvements in a solar fence of the general type described in prior Australian Patent Number 645887. The nature of various improvements, and advantages arising therefrom, will hereinafter become apparent. These include adaptations, changed features, and modified elements, which each improve or upgrade one or more of efficiency in assembly, performance in the field, and/or related cost factors, and which adaptations, features, or elements, might be individually or collectively added to or incorporated in a solar fence of the general kind described in Patent Number No 645887.

The present invention provides a solar energy absorber panel for heating a fluid passed therethrough including:

a plurality of solar absorber subassemblies;

each solar absorber subassemby including one or more absorber tubes mounted, in use, within a solar energy transmissive enclosure, said one or more absorber tubes being extended between upper and lower manifolds;

the plurality of solar absorber subassemblies being interconnected one to another via their respective upper and lower manifolds, to establish the solar energy absorber panel, their interconnection being by intervening connection means;

characterised in that

the parts of the solar absorber subassemblies and the intervening connection means for the interconnection of the upper and lower manifolds utilise mechanical interlocks in assembly, which mechanical interlocks are sealed by an interposed seal.

In a first preferred form, the invention provides a connection means for the interconnection of the upper and lower manifolds of respective subassemblies, which are interconnected thereby, one to another to establish a panel, and ideally but not necessarily, panel to panel to establish a fence, at their respective ends by the same type of intervening connection means, the connection means utilising a form of mechanical interlock, sealed with a suitable sealing means, such as an O-ring seal. The connection means establishes a joint which is simple to assemble and effectively

sealed, without the application of adhesives or sealants. Previously, the manifolds which were joined together to form the top and bottom conduits, doubling as top and bottom fence rails, in the solar fence, each had a male end and a female end. One end fitting of one manifold was joined to an adjoining complementary end fitting by means of a glued connection of the respective mated male and female ends. This complicated the erection process.

In a second preferred form, the invention provides a single piece, extruded glazing means, which glazing contains, in use, absorber tubes, ideally in a disposition which maximises the amount of solar radiation intersected by the absorbers, whilst preferably allowing flow of air about the absorber tubes, to equalise the temperature on the opposed sides of a subassembly and thereby avoid warping and related effects. Ideally the glazing means provides for an increased number of absorber tubes per unit length of fence. Previously the glazing was established by a two part assembly which included first and second opposed facing elements, adapted to be releasablely interconnected at longitudinal side edges. The previous glazing means required additional strength and the aluminium rods that had been proposed in the prior specification to strengthen the absorber subassemblies, are not now needed, as a consequence of having the glazing extruded in a single piece. Additionally, by deleting the aluminium rods, there is space within the glazing means for an

increased number of absorber tubes. This enables realisation of increased efficiency in the solar fence.

In a third preferred form, the invention provides a structure in the upper and lower manifolds whereby absorber tubes are readily mechanically fitted to end sockets with a suitable seal there between, established in the manifold. Additionally a skirt can be provided to mate with the glazing means. It is ideally interacted with the glazing by connector means such as pins, to lock the opposed manifolds, glazing means, and absorber tubes, in an absorber subassembly. Now, instead of each manifold including a spigot extending outwardly of its body portion, for engagement by one end of an absorber tube, the manifolds can have outwardly extended sockets for engagement with the absorber tubes. Where the absorber tubes of the prior specification are glued to spigots, the proposal herein is to preferably connect the ducting members to the manifolds via a mechanical seal, placed inside the new sockets. To prevent an absorber assembly from coming apart, the glazing can be pinned to a skirt on the manifolds at top and bottom.

The material of the manifolds is ideally a suitably reinforced plastic. The connectors may be preferably formed in a similar mouldable material. The absorber tubes are ideally in a suitably corrosion free material such as an extrudable polypropylene, stainless steel or copper tube, the particular choice being determined by

application (metals being more efficient) and what fluid may be flowing in the system. With water and in pool applications, an extrudable grade polypropylene copolymer is preferred. The rubber seals which seal the absorber tubes to the manifolds is preferably an EPDM rubber.

For convenience herein the invention will be described with respect to a solar fence (although it will be clear to those skilled in the art of energy collection that the same panel construction may be used in other applications and dispositions). For convenience the solar energy absorber panels, from which the fence is constructed, will be referred to as panels, the panels being established by interconnection of solar absorber subassemblies (referred to as subassemblies for convenience) by means of connection means. The subassemblies are, in turn, established typically with an array of absorber tubes extended between respective upper and lower manifolds (no particular orientation being implied by reference to upper and lower in any general application of the invention, which terms are adopted for convenience and because they are useful in that they are meaningful in the preferred form of a fence). The means by which the interconnection or joining of solar absorber assemblies is achieved are referred to herein simply as connection means and it is intended that the term will encompass all means to interconnect the absorber assemblies by joining manifolds together, the connection means being

limited only by the functionally significant elements as herein set forth. Whilst reference is made to a solar fence it will be clear that the heat collector or solar panel of the invention may find applications as a heat collector or heating device in other quite disparate circumstances and dispositions, and the invention is not to be limited by reference herein to a solar fence for the heating of swimming pools. The panel of the invention might find use in heating systems in other domestic and industrial applications besides the heating of pools. The panels might be stood against, or be mounted on walls and the like, in whatever disposition achieves the general object of collecting solar energy. It will become clear herein that the panel which arises from the interconnected subassemblies may be either a full panel, in the sense that no provision exists for sight through the assembly, or less than a full panel in that it ideally, but not exclusively, comprises an array of subassemblies, spaced to allow a degree of visibility through the panel in the usual manner of pool fencing. What is significant to the invention is the provision of a means whereby the rays of the sun are able to be intercepted or caught and the energy therein collected in a suitable fluid or gas by which to be transported by or flowed thereby to an application or use thereof. The ratio of actual effective collector area to total panel area (and the area of any holes therein) might be varied to suit particular applications. The width of the panel, the length of a subassembly, or the height of a fence, will be varied to suit

application. The absorber tubes are a means to effect or permit the flow of a substance whereby to transport energy falling on the absorbers to an application thereof, and whilst they are referred to as tubes it will be clear that any entity suited to the purpose is to be called up by the term, including elements with any of the common geometric cross sections, and whilst these will function suitably to a degree, it will be clear that the principles of extending the effect of such an entity, such as the provision of fins, wings, and the like is to be taken to be included by the term tube. The upper an lower manifolds of the invention are broadly elements by which the tubes are operatively interconnected in a useful manner and no particular specific structure is intended by use of the term. Similarly the connection means by which to interconnect the manifolds are structures with no particular attributes except that they provide a means whereby to effect a mechanical interconnection of adjoining manifolds, ideally sealed and disconnectable.

BRIEF DESCRIPTION OF THE DRAWINGS.

The invention will now be described in greater detail with reference to the accompanying drawings in which are shown various preferred embodiments as follows:

FIG. 1 is a connection means in accordance with a preferred form of the invention, seen in plan, by which to join the

manifolds of FIG. 3;

FIG. 2 is the socket end of a manifold into which the connection means of FIG. 1 fits;

FIG. 3 is a longitudinal section through a manifold in accordance with a preferred form of the present invention;

FIG. 4 is a plan view of the manifold of FIG. 3;

FIG. 5 is a transverse section of the manifold of FIGS. 3 and 4;

FIG. 6 shows in transverse section a glazing panel in accordance with a preferred form of the invention;

FIG. 7 shows an alternate form of absorber tube, mounted in a glazing panel of the kind seen in FIG. 6, in accordance with a preferred form of the invention;

FIG. 8 is a transverse section through a subassembly in accordance with a preferred form of the invention; and

FIG. 9 is a detail showing the connection of an absorber tube to a manifold, in accordance with a preferred form of the invention.

PREFERRED EMBODIMENTS.

In FIGS. 1 and 2, the connection means 10 has a plug or spigot end 11 which can be mechanically fitted or locked to socket end 12 of a manifold (as will be described with reference to FIGS. 3

to 5). The connection means 10 has an opposed, second and identical plug or spigot end 20 for connecting or interacting in the same manner with a second manifold (not shown) so as to effectively or operatively connect or join pairs of manifolds together. The plug or spigot end 11 is preferably fitted with an upstanding helical, ridge or flight forming a male thread 13 which engages or cooperates with a complementary helical groove or channel, forming a female thread 14 in the socket of a manifold to be engaged thereby. The plug end 11 can be threaded or rotated into socket end 12 of its manifold up to a shoulder or face 19 of a portion with greater diameter, whereat end face 18 of the manifold butts against or adjoins with shoulder 19, with engagement means, stop, or latch 15 of the connector means, operatively engaged with or locked in the dimple, groove or slot 16 of the manifold, to orient the manifold appropriately. Rotation may be by use of a collet spanner fitted to blind hole 15A. Rotation of the connection means pulls the manifolds at each end thereof together by means of the opposed threads (as shown). The blind hole 15A ideally ends up oriented to the bottom of the rail of interconnected manifolds which it creates. Plug or spigot end 11 of the connector means can be fitted with a channel or groove 17 in which to locate a suitable seal, such as an O-ring seal (not shown). In order to reduce stress on the O-ring seal when the spigot end 11 is inserted in the end of a manifold, the diameter of the spigot end 11 is ideally given a slight reduction in

diameter up to shoulder 70. A corresponding decrease in diameter is ideally made in the manifold at the point 72 to engage with the reduced diameter of the connector. In assembly of a panel, the subassemblies are interconnected by rotation of the connection means therebetween, preferably by use of a collet spanner which may be engaged, in use, in the hole 15A in FIG. 2.

In FIGS. 3 to 5 is seen detailed views of a manifold 21 with passages or openings 23 to align with absorber tubes (not shown) inserted in absorber tube sockets 25, which are extended from the main body 63 of the manifold. In this embodiment the main bore of the manifold is shown with the same diameter along its length. As described in FIG. 1, it may be reduced to mate with a connection means which is itself of constant diameter. Again it is preferred to make the variation in diameter for the reasons set out above. The manifold also has a glazing skirt 24 within which glazing (not shown) may be mounted in use (see below). The respective ends of the manifold can have the female thread or screw means 14 and slot or notch 16 in end 12, as described with respect to FIG. 1. The glazing skirt 24 can be fitted with internal ridges or ribs 27 to act as end stops or shoulders, to restrict or limit the depth or degree to which the glazing is inserted or fits into the glazing skirt 24. The glazing skirt 24 can be bored or holed at 26 whereat to pass suitable connectors or pins by which to interconnect or fix the glazing to the manifold. The

respective ends 28 of the glazing skirt 24 are ideally shaped or extended as shown. The absorber tubes of the invention (see below) are passageways or conduits which in use align with a respective passage or bore 23 of the respective manifold, being each plugged into, in use, an absorber tube socket 25 of the manifold, with a mechanical seal therebetween by which to seal their joint or connection against leakage of the fluid therein. In use, the cavity or well 61 which is created or exists between the glazing skirt 24 and the absorber tube sockets 25 might collect water draining thereto down the glazing. This can be released by provision of a means to enable it to drain, which means might be a suitably located passage or hole, or, preferably, a slot 62 in the glazing skirt 24, which is easier to form in the moulding of the manifold. The skirt 24 can be extended at 41 for receipt therein of a rib on the glazing panel as will be seen in FIG. 6.

In FIG. 6 there is seen a transverse section through a glazing panel 29, in which can be fitted an array of absorber tubes such as 37,38 in FIG. 6. The glazing panel 29 can be provided with internal partitions, flanges or ribs, such as ribs 32, by which to reinforce or strengthen the glazing panel 29, and by which to align or support the absorber tubes, such as 37,38 in FIG. 6. The external surface of the glazing panel may be rippled or ribbed, such as at 36 to act as a diffuser and to improve the appearance of the glazing. These

diffuser ribs may be repeated across the surface, and be placed on both sides of the glazing. Those sections of the glazing panel which are to interact with the means to connect to the manifolds, such as section 34, may be bored or holed as at 35, and these passageways correspond (in use) with the holes 26 (of FIG. 3) for the receipt of connector elements by which to interconnect or lock the glazing panel with its respective upper and lower manifolds. As seen in FIG. 6 the internal ribs 32 may interact to a degree with fins or wings, such as fin 41. These act to enclose them with allowance for air flow thereabout. Additionally they may assist in stopping buckling in the absorber tubes. The cavity 40 in the end 31 provides space for the wing 39 of the end tube 37. The fins or wings of the absorber tubes serve to intercept solar energy with a reduced number of tubes in place. Rib 42 engages in extension 41 of FIG. 4. The end ribs 42 may be provided to restrict the gap between adjoining subassemblies when it is desired to effect such restriction.

In FIG. 7 is seen an alternate form of absorber tube. These tubes are ideally circular in cross section. Between them are mounted inserts to substitute for the fins of the previous embodiment. The round tubes may be in stainless steel, or alternately in copper. The inserts may ideally be an extrusion with arcuate ends (when butted against round tubes, a complementary shape being desirable to gain good heat flow therebetween) such as 46,47 on insert 43

between tubes 44,45. The inserts and metal tubes are effective to increase the thermal efficiency of the absorbers. They can result in water being heated to greater temperatures.,

In FIG. 8 is seen a transverse section through an absorber assembly, with a glazing panel 52 extended between its upper and lower manifolds 58, 59. Within the glazing panel 52 are absorber tubes such as 55, with wings 56, 57, and open to upper and lower flow passages 53.54. Between the absorber tube 55 and the tube joiner of the manifold 59 is preferably a mechanical seal 60 (see Fig. 9 for more detail). Connector means 66,67 provide the mechanism by which the upper manifold 58 can be joined, in use, to its adjoining absorber assemblies (not shown) in the construction of a fence panel. Similarly connector means 68,69 interconnect lower manifolds together.

In FIG. 9 is seen a detailed view of a mechanical joint between an absorber tube 87 and a manifold socket 88 projected from manifold 89. A seal or gasket 90 exists between the two with a top flange or rim 91 restricting movement of the seal 90 into the socket 88 when absorber tube 87 is pushed therein. Element 92 of the drawing is a wing to the tube.

CLAIMS.

1. A solar energy absorber panel for heating a fluid passed therethrough including:

a plurality of solar absorber subassemblies;

each solar absorber subassemby including one or more absorber tubes mounted, in use, within a solar energy transmissive enclosure, said one or more absorber tubes being extended between upper and lower manifolds;

the plurality of solar absorber subassemblies being interconnected one to another via their respective upper and lower manifolds, to establish the solar energy absorber panel, their interconnection being by intervening connection means;

characterised in that

the parts of the solar absorber subassemblies and the intervening connection means for the interconnection of the upper and lower manifolds utilise mechanical interlocks in assembly, which mechanical interlocks are sealed by an interposed seal.

2. A solar energy absorber panel as claimed in claim 1 wherein the connection means includes respective, counter rotating screw mechanisms at opposed ends, to draw the connector, in use, into respective, threaded, adjoining manifold ends to effect connection of subassemblies upon its being rotated.

3. A solar energy absorber panel as claimed in claim 2

wherein the respective opposed ends of the connection means are circumferentially grooved for receipt of an O-ring seal and the connection mean and manifold diameters are adapted to allow reduced friction insertion over a portion of the insertion distance before the O-ring engages and effects a seal.

4. A solar energy absorber panel as claimed in claim 1 wherein the solar energy transmissive enclosure is an extruded glazing means enclosing a passage therethrough, which passage, in use, houses the one or more absorber tubes, in a disposition which allows a flow of air about the absorber tubes, effective to equalise the temperature on the opposed sides of a subassembly.

5. A solar energy absorber panel as claimed in claim 4 wherein the solar energy transmissive enclosure provides transversely extended flat, solar transmissive faces and mounts therein a plurality of oppositely finned absorber tubes, each mounted therein between pairs of opposed ribs extended inwardly of the flat faces to abut the absorber tubes.

6. A solar energy absorber panel as claimed in claim 1 wherein the absorber tubes are interconnected by interposed elongate, heat conductive collector plates, spanning the gap therebetween, and butted thereto, for flow of heat between the elongate collector plates and the absorber tubes.

7. A solar energy absorber panel as claimed in claim 6

wherein the interposed elongate collector plates have transverse end plates configured to compliment the external surface of the energy absorber tubes and butt closely thereto over an extended surface area.

8. A solar energy absorber panel as claimed in claim 1 wherein there are one or more outwardly extended spouts on the upper and lower manifolds whereat the absorber tubes are each mechanically connected in plug and socket fashion, with a seal there between.

9. A solar energy absorber panel as claimed in claim 8 wherein the upper and lower manifolds are each provided with a skirt, extended about the one or more spouts and complementary in section to the solar energy transmissive enclosure , interacted, in use, with the solar transmissive enclosure in plug and socket fashion, and held together by locking means.

10. A solar energy absorber means as claimed in claim 9 wherein the locking means are pins passed through the skirt and solar transmissive enclosure.

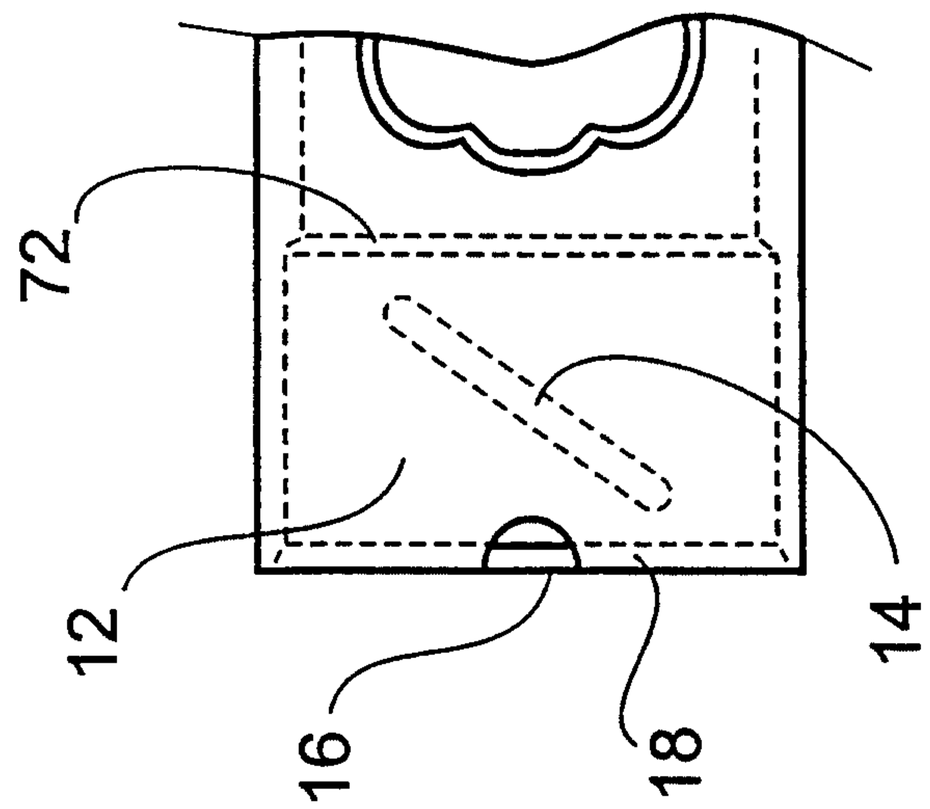


FIG. 2

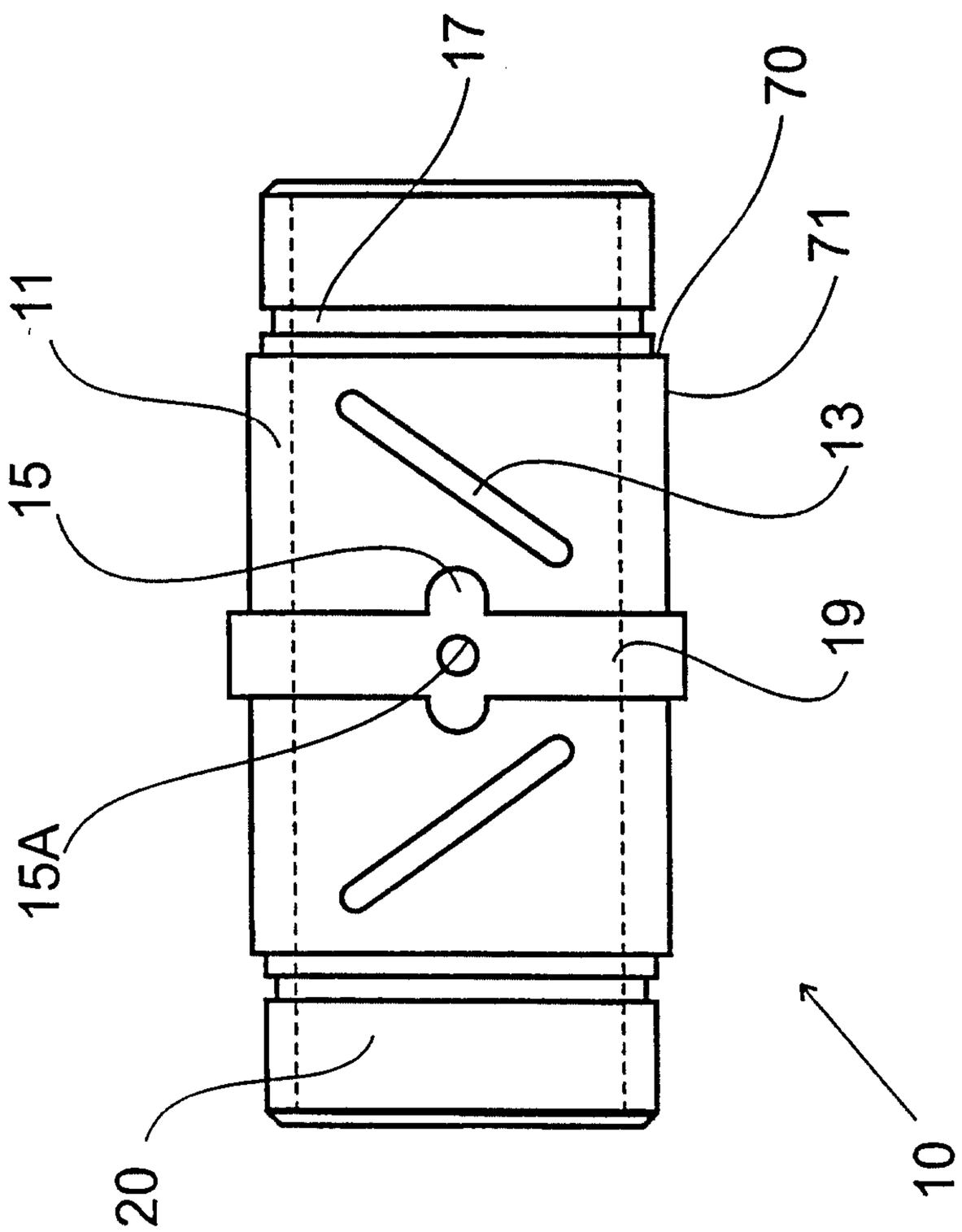
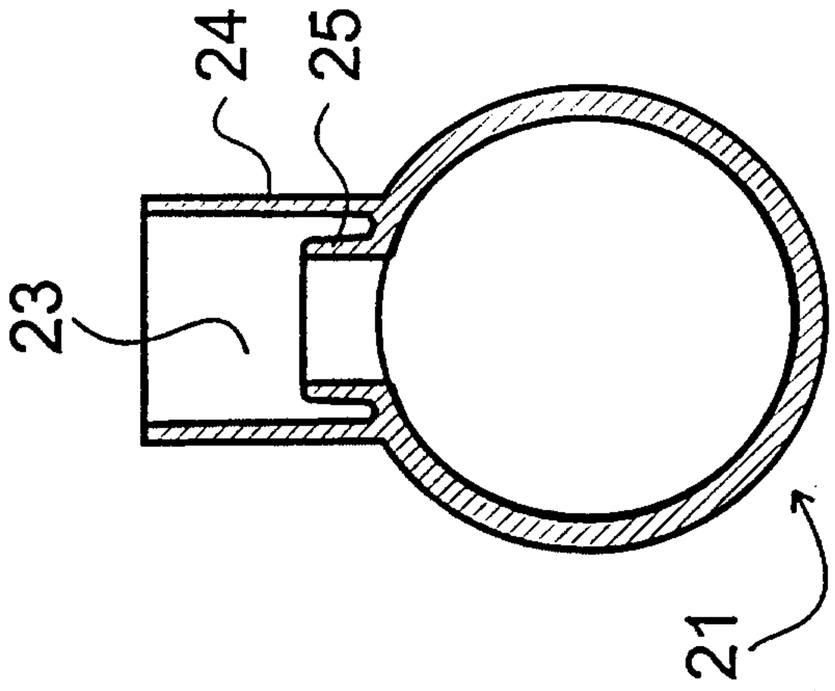


FIG. 1



SECTION A-A

FIG. 5

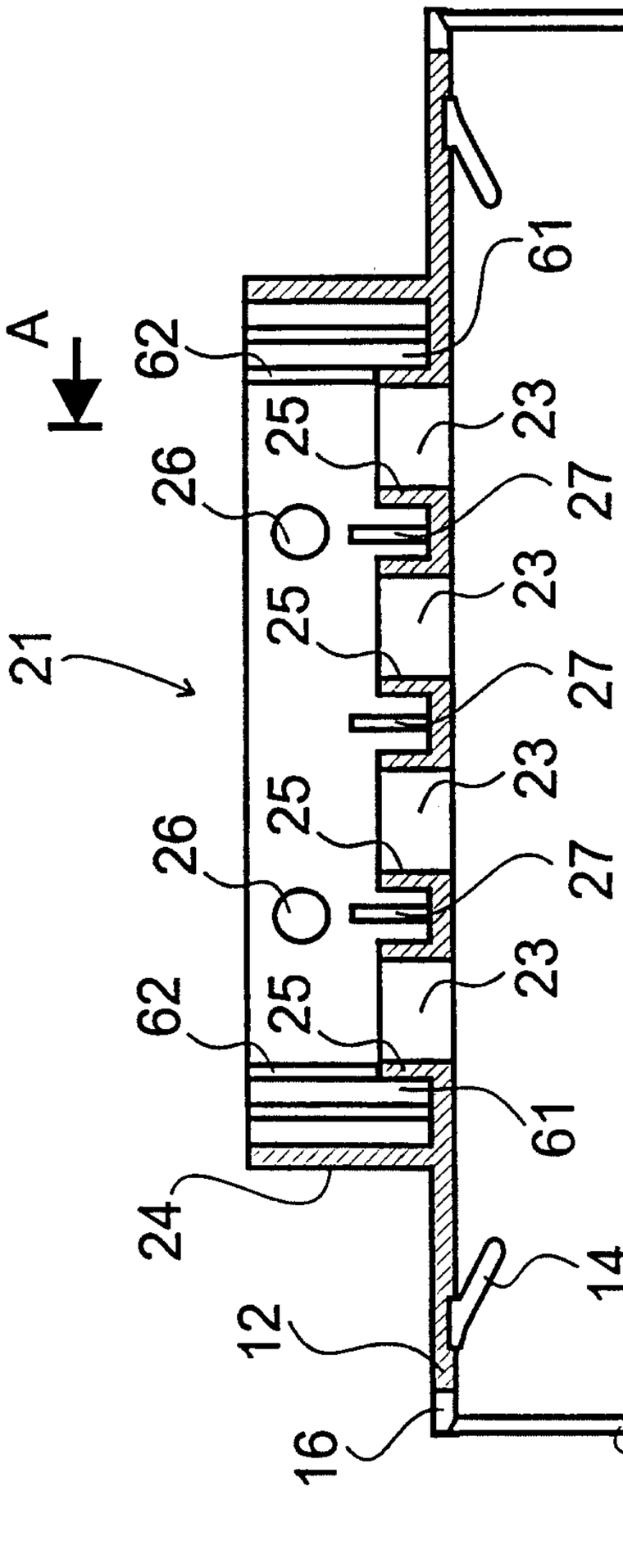


FIG. 3

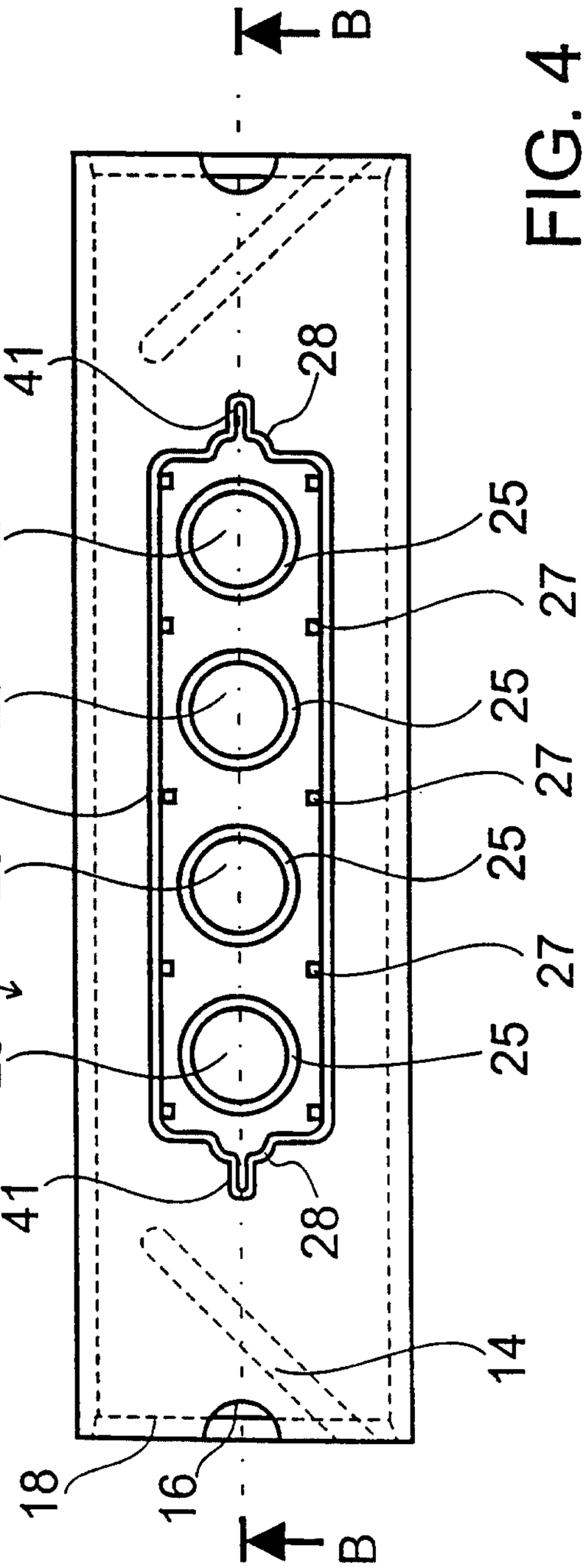


FIG. 4

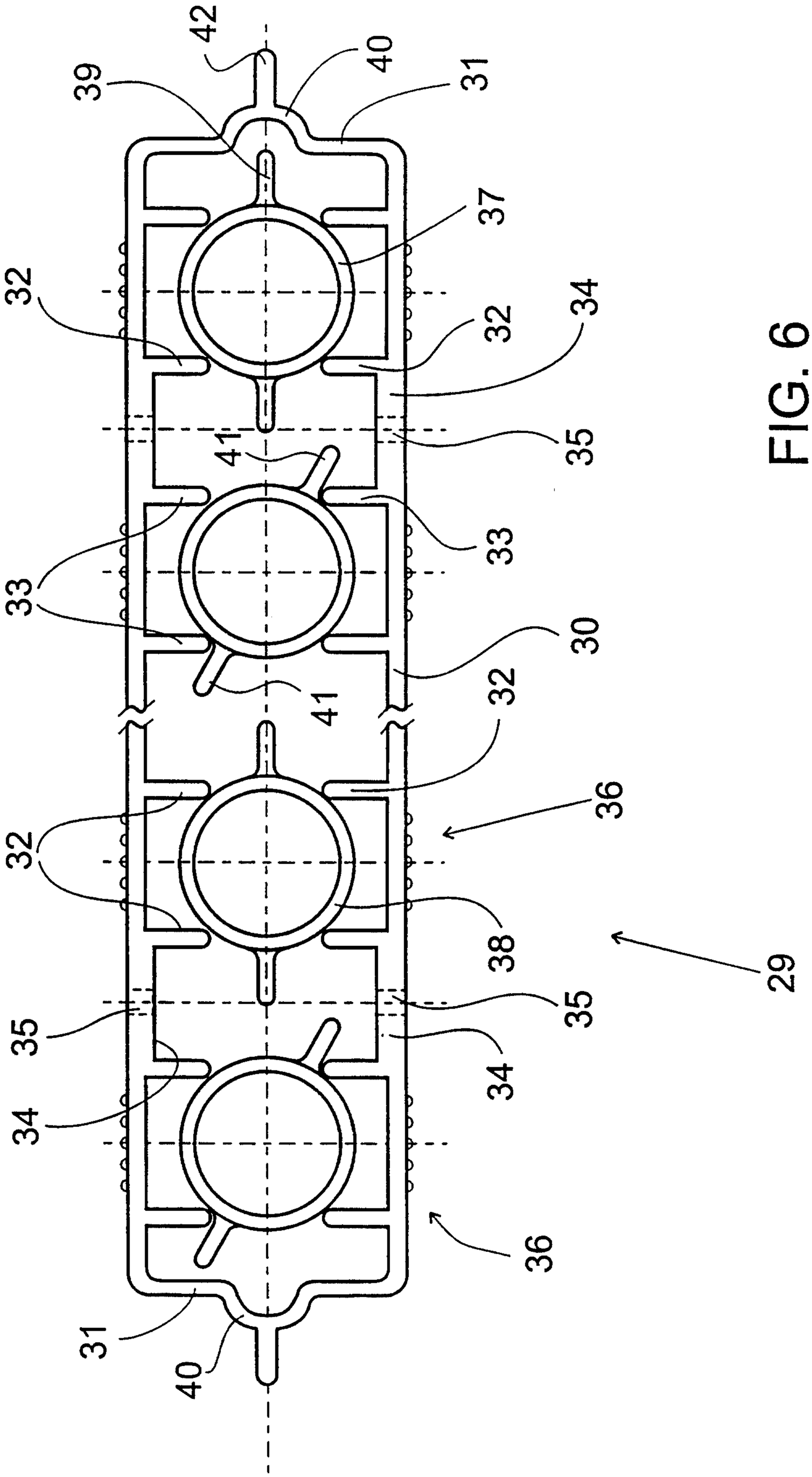

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FIG. 6

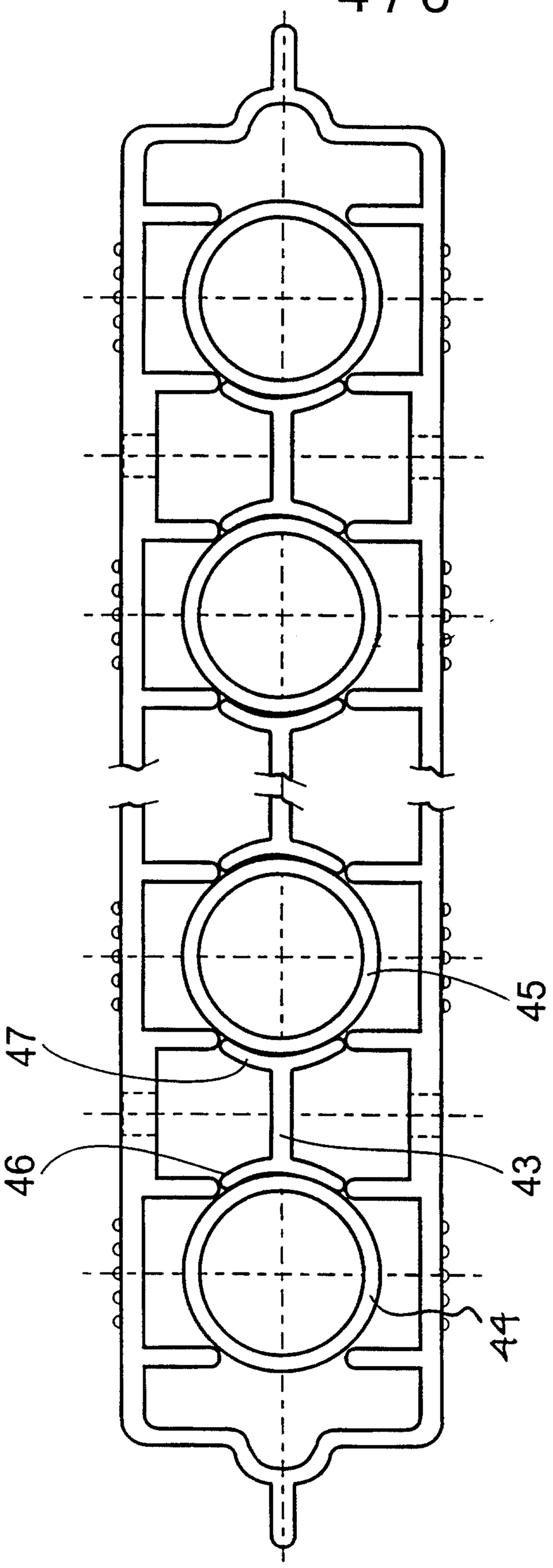


FIG. 7

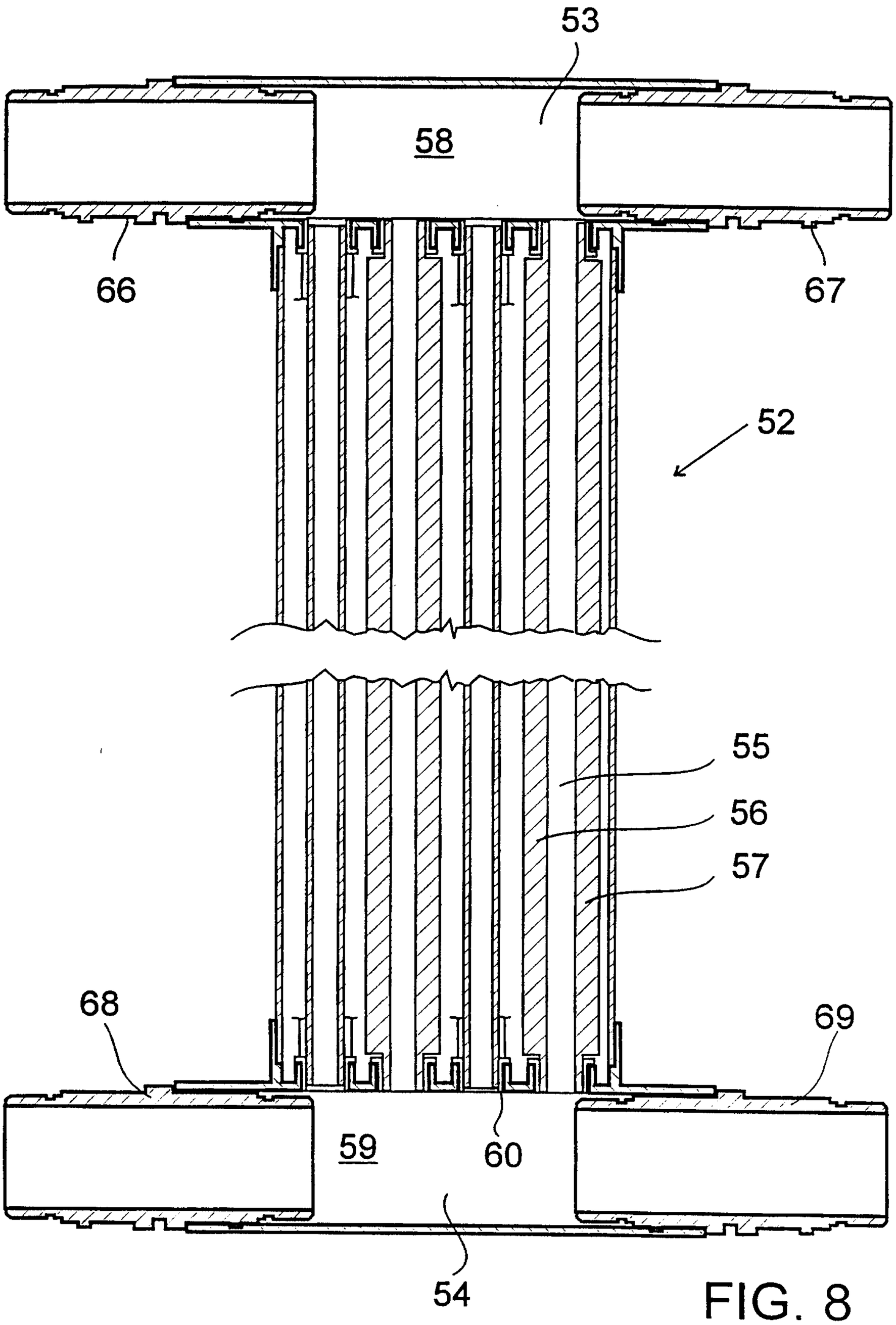


FIG. 8

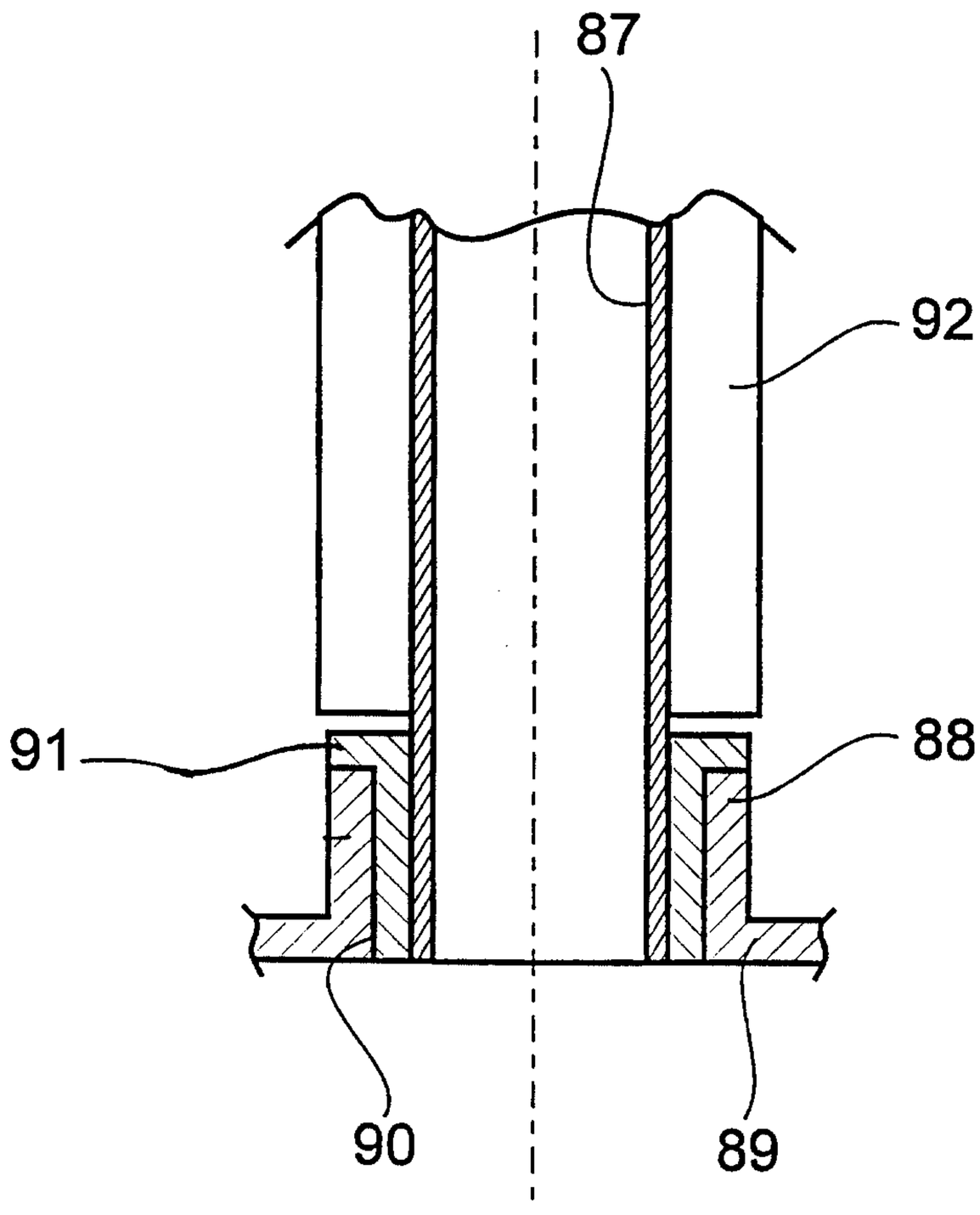


FIG. 9