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(54) **Heating element for a radiator**

(57) A heating element for radiators (50), comprising a modular body obtained by extrusion with longitudinal extension and shaped cross section, said body comprising a tubular portion (52) internally delimiting a duct for the circulation of a heating fluid; a plurality of longitudinal fins (54) extending from said tubular portion (52); branches (55) that extend from at least one of said longitudinal fins (54); wherein at least one of said branches (55) delimits at least one longitudinal channel (56); at least one of said longitudinal channels (56) being suitable: for the connection of at least one second modular body of a heating element; or for the connection of at least one fixing element; or for the connection of at least one accessory; and wherein said tubular portion (52), said at least one plurality of fins (54) and said branches (55) are in a single piece.

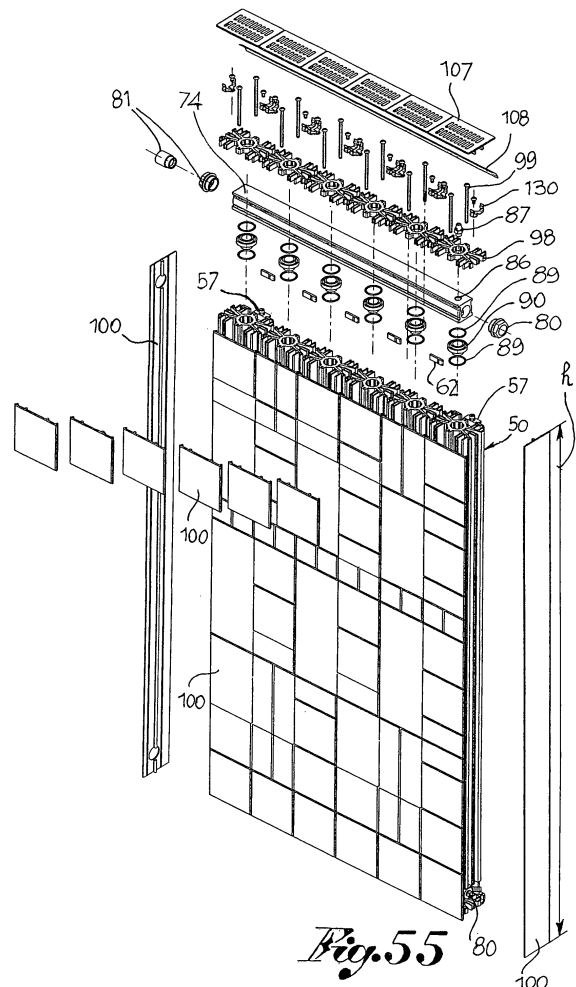


Fig. 55

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Description

[0001] . The present invention relates to a modular radiator for heating systems, and in particular a modular radiator comprising particular heating elements, front covers and/or joints.

[0002] . Known modular radiators comprise a series of heating elements connected to one another, which comprise one or more ducts for a heating fluid and one or more fins for improving the heat exchange between the heating fluid and the air to be heated.

[0003] . In order to regulate the calorific power of the radiator, it is possible to add or remove some heating elements from such series, but no further changes and/or adaptations of the radiator are possible, neither aesthetic nor technical, due to the relatively complex structure of the heating elements, and due to the fixed distance between centres between the inlet and the outlet of the ducts for the heating fluid. Therefore, the modularity of known radiators is only vertical or horizontal.

[0004] . The object of the present invention therefore is to provide a modular radiator without such disadvantages.

[0005] . Said object is achieved with a heating element, a radiator, a cover and a union whose main features are respectively detailed in claims 1, 50, 123 and 133, whereas further features are detailed in the remaining claims.

[0006] . Further advantages and features of the heating element and radiator according to the present invention will appear more clearly from the following detailed and non/limiting description of preferred embodiments, with reference to the annexed drawings, wherein:

[0007] . figure 1 shows a top view of a heating element and of the cover thereof;

[0008] . figure 2 shows a front partial view of the heating element of figure 1;

[0009] . figure 3 shows a perspective partial view of the heating element of figure 1;

[0010] . figure 4 shows a rear partial view of the cover of figure 1;

[0011] . figure 5 shows a perspective partial view of the cover of figure 1;

[0012] . figure 6 shows a top view of a radiator comprising three heating elements of figure 1;

[0013] . figure 7 shows an enlarged top view of detail VII of figure 6;

[0014] . figure 8 shows a perspective view of detail VII of figure 6;

[0015] . figure 9 shows a rear view of the radiator of figure 6;

[0016] . figure 10 shows a perspective view of the radiator of figure 6;

[0017] . figure 11 shows a perspective view of a joint of the radiator of figure 6;

[0018] . figure 12 shows a front view of the joint of figure 11;

[0019] . figure 13 shows a perspective view of a portion with limited longitudinal extension of a heating element

according to a further embodiment;

[0020] . figure 14 shows a top view of the heating element of figure 13;

[0021] . figure 15 shows a front view of the heating element of figure 13;

[0022] . figure 16 shows a side view of the heating element of figure 13;

[0023] . figure 17 shows a perspective top view of a manifold for the fluid connection of multiple heating elements according to an embodiment;

[0024] . figure 18 shows a perspective bottom view of the manifold of figure 17;

[0025] . figure 19 shows a bottom view of the manifold of figure 17;

[0026] . figure 20 shows a front partly sectioned view of the manifold of figure 17;

[0027] . figure 21 shows a top view of the manifold of figure 17;

[0028] . figure 22 shows a side view of the manifold of figure 17;

[0029] . figure 23 shows a cross section view of the manifold of figure 17 at one cross or transversal opening thereof for the connection to a heating element;

[0030] . figure 24 shows a perspective top view of a manifold for the connection of a plurality of heating elements according to a further embodiment;

[0031] . figure 25 shows a perspective bottom view of the manifold of figure 24;

[0032] . figure 26 shows a bottom view of the manifold of figure 24;

[0033] . figure 27 shows a front partly sectioned view of a manifold according to a further embodiment;

[0034] . figure 28 shows a top view of the manifold of figure 24;

[0035] . figure 29 shows a side view of the manifold of figure 24;

[0036] . figure 30 shows a transversal section view of the manifold of figure 24 at one transversal opening thereof for the connection to a heating element;

[0037] . figure 31 shows a perspective top view of a junction element to be arranged between the manifold and a heating element connected thereto;

[0038] . figure 32 shows a perspective bottom view of the junction element of figure 31;

[0039] . figure 33 shows a front view of the junction element of figure 31;

[0040] . figure 34 shows a top view of the junction element of figure 31;

[0041] . figure 35 shows a cross section view of the junction element of figure 31;

[0042] . figure 36 shows a perspective top view of a manifold locking element;

[0043] . figure 37 shows a top view of the manifold locking element of figure 36;

[0044] . figure 38 shows a front view of the manifold locking element of figure 36;

[0045] . figure 39 shows a side view of the manifold locking element of figure 36;

[0046] . figure 40 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto according to an embodiment;

[0047] . figure 41 shows a top view of the plurality of elements with covers of figure 40;

[0048] . figure 42 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto according to a further embodiment;

[0049] . figure 43 shows a top view of the plurality of elements with covers of figure 42;

[0050] . figure 44 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto according to an even further embodiment;

[0051] . figure 45 shows a top view of the plurality of elements with covers of figure 44;

[0052] . figure 46 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto according to a further embodiment;

[0053] . figure 47 shows a top view of the plurality of elements with covers of figure 46;

[0054] . figure 48 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto covering the four sides of the plurality of heating elements according to a further embodiment;

[0055] . figure 49 shows a top view of the plurality of elements with covers of figure 48;

[0056] . figure 50 shows a perspective view, with limited longitudinal extension, of a plurality of heating elements disposed side by side and aligned with the interposition of pins;

[0057] . figure 51 shows a front partly sectioned view of the plurality of heating elements of figure 50;

[0058] . figure 52 shows a top view of the plurality of heating elements of figure 50;

[0059] . figure 53 shows a perspective view, partly as exploded view and with limited longitudinal extension, of a plurality of heating elements sided to one another with covering panels coupled thereto and connection elements screwed thereto according to an embodiment;

[0060] . figure 54 shows a top view of the plurality of elements with covers and connection elements for accessories of figure 53;

[0061] . figure 55 shows a front perspective view as exploded view of a radiator according to an embodiment;

[0062] . figure 56 shows a front perspective view of the radiator of figure 55;

[0063] . figure 57 shows a rear perspective view as exploded view of a radiator according to an embodiment;

[0064] . figure 58 shows a rear perspective view of the radiator of figure 57;

[0065] . figure 59 shows a cross section view of a radiator at its connection elements to a support portion;

[0066] . figure 60 shows a top detail view of the section of figure 59;

[0067] . figure 61 shows a bottom detail view of the section of figure 59;

[0068] . figure 62 shows a perspective view of a radiator in four different positions, while it swings around the bottom connection hinges to the support wall;

[0069] . figure 63 shows a side view of the four positions of figure 62;

[0070] . figures from 64 to 69 schematically show radiators without the cover panels wherein the inflow directions and the inlet openings and respectively, outlet openings of a fluid are indicated with arrows, and the openings closed by respective caps are indicated with X.

[0071] . With reference to figures from 1 to 3, it can be seen that the radiator according to the present invention comprises at least one heating element that includes a first rectangular plate 1 connected to at least one duct 2 for a heating fluid. The longitudinal axis of duct 2 is parallel to the median axis of plate 1 and is arranged substantially in the middle behind the plate itself. A plurality of longitudinal fins 3 and/or 4 respectively protrudes from the front and/or rear surface of plate 1. Moreover, the rear surface of plate 1 is provided with a plurality of longitudinal channels 5 and 6 that can seat screws for connecting the heating element to other heating elements, to fixing elements and/or to connection accessories.

[0072] . Plate 1, duct 2, the longitudinal fins 3, 4 and the longitudinal channels 5, 6 are preferably made in a single piece of extruded metal material, in particular aluminium or alloys thereof. A first pair of longitudinal channels 5 is arranged along the side edges of plate 1, whereas a second pair of longitudinal channels 6 is arranged at the sides of duct 2. In particular, the first longitudinal channels 5 are obtained in a pair of side walls made of a single extruded piece with plate 1 along the side edges thereof. These side walls comprise a plurality of third longitudinal channels 7 that are open on the side and are shaped for seating complementary portions of coupling elements (described hereinafter). A diaphragm 8 made of a single extruded piece with plate 1 connects the second longitudinal channels 6 and can be provided with at least one hole 9 for connecting duct 2 to the rear side of the heating element. Also plate 1 can be provided with holes 10 obtained between fins 3 and 4, so that the screws can cross these holes to be screwed at fourth longitudinal channels 11 connected to a second rectangular plate 12 for a front cover 13 for the heating element. One or more fifth longitudinal channels 14 can protrude from the front surface of plate 1 between the front fins 3 opposite the fourth longitudinal channels 11 of cover 13. To this end, the width and/or the reciprocal distance of the fourth longitudinal channels 11 are substantially equal to the width and/or to the reciprocal distance of the

fifth longitudinal channels 14. One or more walls of one or more fourth longitudinal channels 11 are preferably provided with first side ribs 15 adapted for engaging with second side ribs 16 that protrude from the side walls and/or from the front fins 3 of plate 1, for joint-wise connecting the front cover 13 to plate 1.

[0073] . With reference also to figures 4 and 5, it can be seen that the fourth longitudinal channels 11 of the front cover 13 are suitably made in a single piece of extruded material, in particular aluminium, its alloys or plastic, with the second rectangular plate 12. The width of the second plate 12 is substantially equal to, or is a multiple or submultiple integer of the width of the first plate 1 of the heating element. The side edges of the second plate 12 can further be provided with side walls 17 adapted for covering at least partly the sides of the heating element.

[0074] . With reference now to figures from 6 to 10, it can be seen that the radiator according to the present invention comprises for example three heating elements that are cut to the desired size and connected to one another, sided to one another, by a plurality of coupling elements 18 comprising a pair of parallel pins that can be introduced from top or from the bottom into two third channels 7 of two adjacent heating elements, in the direction of the arrow of figure 8. To strengthen the connection between the heating elements, a plurality of perforated bars or plates 19 connects at least two heating elements by screws 20 which are inserted into the holes of these plates or bars 19 and are screwed into the first and/or second longitudinal channels 5, 6 of these heating elements. Ducts 2 of the heating elements are connected to one another by cross pipes 21 having the ends provided with L joints 22 inserted into holes 9 obtained in diaphragms 8 close to the ends of ducts 2. Holes 9 and joints 22 are preferably threaded. The ends of ducts 2 are capped, so that pipes 21 and ducts 2 form a hydraulic circuit for the heating fluid. Holes 9 at the ends of this hydraulic circuit are provided with special joints with branching 23, which shall be described hereinafter and which may be provided with valves 24. One or more front covers 13 can be cut to the desired size and fixed to a heating element by screws 25 inserted into holes 10 of this heating element and screwed in the fourth longitudinal channels 11 of these front covers 13. By adjusting the screwing length of screws 25 and inserting suitable spacers, if needed, the second plates 12 of front covers 13 can be arranged in contact with the front fins 3 of the corresponding heating elements or at a given distance therefrom, so as to allow or prevent heat conduction between fins 3 and the second plates 12. As an alternative or in addition to this arrangement, the walls of the fourth longitudinal channels 11 of the second plate 12 can match or not the corresponding walls of the fifth longitudinal channels 14. Figure 7 shows the fourth channel 11 on the left separate from the corresponding fifth channel 14, whereas the fourth channel 11 on the right is in contact with the corresponding fifth channel 14. The second

plates 12 can further be perforated for fixing by screws at the front one or more accessories, for example a towel rail 26.

[0075] . One or more brackets 27 can further be fixed behind the heating elements by screws screwed in the longitudinal channels 5 and/or 6.

[0076] . Figures 11 and 12 show a joint with branching 23, which comprises a third plate 28 provided with two sixth longitudinal channels 29 parallel to one another and a hole 30 arranged between these two sixth channels 29. A plurality of holes 31 is further obtained in the sixth channels 29, so as to allow screwing plate 28 behind a heating element with hole 30 aligned with a hole 9 obtained in diaphragm 8 of the heating element and the sixth channels 29 that contain the walls of the second channels 6 arranged at the sides of hole 9 of this heating element. Therefore, the screws inserted in holes 31 of the third plate 28 can be screwed in these second channels 6. To this end, the distance between the centre of hole 30 and the median axis of the sixth channels 29 of joint 23 is substantially equal to the distance between the centre of hole 9 and the median axis of the second channels 6 of a heating element. Holes 9 and/or 30 can be provided with circular seats for seating an annular seal. A body 32 provided with holes 33 connected to hole 30 is fixed behind plate 28, so as to connect duct 2 of a heating element to a heating system through holes 9, 30 and 33. Holes 33 can be threaded for the connection to threaded joints and/or valves, such as valve 24.

[0077] . The walls of one or more longitudinal channels 5, 6, 11 and/or 14 can be made of a material suitable for being cut into by self-threading screws and/or they can comprise shaped seats for threaded nuts.

[0078] . Any variants and/or additions can be made by the men skilled in the art to the embodiment of the invention described and illustrated herein without departing from the invention itself.

[0079] . Figures from 13 to 69 shows further embodiments of heating elements forming modules for radiators, as well as radiators comprising said elements.

[0080] . According to a generic embodiment, a heating element 50 for radiators 51, comprises a modular body. Said body is preferably obtained by extrusion and it exhibits a prevailing longitudinal extension and shaped cross section. Advantageously, said body comprises a tubular portion 52 internally delimiting a duct 53 adapted for the circulation of a heating fluid (figures from 13 to 16).

[0081] . According to an embodiment, a plurality of longitudinal fins 54 extends from said tubular portion 52. Advantageously, branches 55 extend from at least one of said longitudinal fins 54

[0082] . Advantageously, at least one of said branches 54 delimits at least one longitudinal channel 56. Preferably, at least one of said longitudinal channels 56 is adapted for the connection of at least one second modular body of a heating element 50, or for the connection of at least one fixing element 57 or 58, such as a bracket for the connection to a support such as a wall, or for the

connection of at least one accessory 59, such as by way of an example only, a connection bracket for a towel rail (figures 57, 53 and 54).

[0083] . With a further advantage, said tubular portion 52, said at least one plurality of fins 54 and said branches 55 are in a single piece, or they are obtained from a single extruded piece.

[0084] . According to an embodiment, said at least one of said longitudinal channels 56 comprises a portion forming a snap-wise coupling seat 60. Preferably, at least one of said longitudinal channels 56 comprises a localised enlargement 60.

[0085] . Advantageously, at least one of said longitudinal channels 56 comprises a portion forming a seat for a geometrical coupling.

[0086] . According to an embodiment, at least one of said channels 56 comprises an undercut portion 61.

[0087] . Advantageously, at least two longitudinal channels 56 are opposed to one another and preferably, at least four longitudinal channels 56 are provided, opposed two by two and even more advantageously, at least six longitudinal channels 56 are provided, opposed two by two.

[0088] . According to an embodiment, at least two opposed longitudinal channels 56 are provided adapted for the connection of the heating element to an adjacent heating element, for example by an alignment pin 62 (figures 50, 51, 52).

[0089] . According to an embodiment, at least one longitudinal channel 56 comprises a cross section substantially shaped as a C and preferably, at least one longitudinal channel is delimited by arms 54 or branches 55 with a substantially equal extension to one another.

[0090] . According to an embodiment, said body of the heating element exhibits a prevailing longitudinal extension.

[0091] . Heating element means any element adapted for the transfer of heat between a fluid circulating in duct 53 delimited by the tubular portion 52 and the external fluid that touches said tubular portion 52 and the entire extended surface that surrounds said longitudinal fins 54 or said arms 54 and said branches 55. This transfer of heat can be both towards the external fluid and towards the internal fluid, if a cooling fluid circulates into said duct 53.

[0092] . Advantageously, said body extends according to an axis X-X.

[0093] . Preferably, said body and said longitudinal fins 54 along with said branches 55, in a plane transversal to said body, or to said axis X-X, exhibit an overall dimension fully inscribable in a rectangle, indicated in figure 14 with reference numeral 63.

[0094] . According to an embodiment, said body and said longitudinal fins along with said branches, in a plane transversal to said body, exhibit an overall dimension fully inscribable in a square.

[0095] . Advantageously, said body comprises a front (F) having fixed width (L) and, for example, said body

comprises a back (R) having fixed width and for example, said body comprises a side (S) having fixed width (1), as well as an opposed side of fixed width and a top (U) and a bottom (D) (figures 14 and 15).

[0096] . According to an embodiment, said body comprises a cross section specularly symmetrical relative to a median axis A-A. Advantageously, said body comprises a cross section specularly symmetrical relative to an axis B-B transversal to a median axis A-A.

[0097] . Even more preferably, said body comprises a cross section symmetrical relative to two axes A-A and B-B orthogonal to one another.

[0098] . According to an embodiment, said tubular portion 52 of said body comprises an inner surface 64 adapted for touching or lapping a heating or cooling fluid. Advantageously, longitudinal ribs 65 extend internally from the inner surface of said tubular portion 52. Preferably, a plurality of longitudinal ribs 65 extends internally from the inner surface of said tubular portion 52, for example, longitudinal ribs 65, preferably circumferentially equally spaced from one another, extend internally and radially. According to an embodiment, longitudinal ribs 65 extend internally from the inner surface of said tubular portion 52, comprising at the free end a guide surface 66, preferably, guide surfaces forming portions of a single guide and centring surface (figure 14).

[0099] . According to an embodiment, said tubular portion 52 comprises on the outside at least one longitudinal rib 67, preferably two longitudinal ribs 67 opposed to one another.

[0100] . Advantageously, said tubular portion 52 comprises on the outside at least one longitudinal rib 67 comprising at least one preferably threaded longitudinal hole 68.

[0101] . According to an embodiment, said tubular portion 52 comprises at the end a duct opening 69 delimited by a sealing and abutment surface 70. Advantageously, said tubular portion 52 comprises at both ends a duct opening 69 delimited by a sealing and abutment surface 70.

[0102] . According to a further embodiment, said longitudinal fins 54 in cross section form arms extending from said tubular portion 52. Advantageously, at least one of said arms 54 substantially extends in radial direction from said tubular portion 52. Preferably, at least one pair of said arms 54 extends from said tubular portion 52 in opposed directions. With a further advantage, at least one pair of said arms 54 extends from said tubular portion 52 in opposed directions, remaining substantially on a same median plane (A-A) orthogonal to the cross section of said body.

[0103] . According to an embodiment, at least one pair of said arms 54 extends from said tubular portion 52 substantially forming a V shape (shape that, for example, opens an angle P-P with the arms). Advantageously, at least one pair of said arms extends from said tubular portion substantially forming a V shape within which a third arm 71 is comprised. Preferably, at least one pair

of said arms 54 extends from said tubular portion 52 substantially forming a V shape within which a third arm 71 is comprised, with two branches 72 forming a substantially Y-shaped or diapason shape.

[0104] . According to an embodiment, a plurality of branches 55 parallel to one another extends in cross section to said body from at least one arm 54. Advantageously, a plurality of branches 55 extends in cross section to said body from at least one arm 54 according to a direction transversal to a symmetry axis A_A of said section.

[0105] . According to an embodiment, at least one of said branches 55 comprises a narrowing of section 60 transversally to the body.

[0106] . According to a further embodiment, branches 55 of opposed arms 54 are parallel to one another.

[0107] . According to an even further embodiment, at least one of said branches 55 comprises a substantially localised enlargement 73. Advantageously, said enlargement 73 forms an abutment for a covering panel. Advantageously, at least one of said branches 55 comprises an enlargement delimiting an undercut 61.

[0108] . According to an embodiment, a manifold 74 for the fluid connection of heating elements 50 comprises a body obtained by extrusion (figures from 17 to 30).

[0109] . Advantageously, said manifold 74 is connected to the heating elements 50 with body arranged transversally to the longitudinal extension thereof (figures from 55 to 61).

[0110] . Advantageously, said manifold 74 internally delimits a duct 75 adapted for putting the heating elements 50 in fluid communication. According to an embodiment, said manifold 74 comprises a flat side 76 adapted for facing the heating elements 50. Preferably, said manifold 74 comprises a flat side 77 opposed to its side 76 adapted for facing the heating elements 50.

[0111] . According to an embodiment, said manifold 74 comprises at least one opening 78 in a side 76 facing the heating elements 50. Preferably, said manifold comprises at least one opening 78 in a side 76 facing the heating elements 50 adapted for the fluid connection with duct 53 delimited by the tubular portion 52 of the heating element 50. Preferably, said manifold 74 comprises at least two openings 78 in a side 76 facing the heating elements 50 adapted for the fluid connection with ducts 53 delimited by the tubular portions 52 of the heating elements 50, so as to obtain a fluid path or circuit between a first of said heating elements and at least one second of said heating elements (figures from 55 to 61).

[0112] . According to an embodiment, said manifold 74 comprises a body with end openings 79, advantageously, at least one of which is threaded and adapted for the connection of a closing cap 80 or of a joint 81 for the connection to a hydraulic circuit.

[0113] . According to an embodiment, said manifold 74 having a body delimiting a duct 75 comprises a partition 82 adapted for the fluid partition of said duct 75 into two branches 83, 84.

[0114] . Advantageously, said manifold 74 having a

body delimiting a duct 75 comprises a partition 82 arranged between two openings 85 and 86 transversal to said duct, for the connection of the manifold to a hydraulic system. Preferably, said cross openings 85, 86 are threaded.

[0115] . According to an embodiment, said manifold 74 has a body delimiting a duct 75 that comprises an opening 86 adapted for the connection of an exhaust valve 87 for the air in case present in the radiator or in the system connected thereto.

[0116] . According to an embodiment, said manifold 74 having a body delimiting a duct 75 comprises a plurality of openings 78 adapted for the fluid connection of said manifold 74 to the heating elements 50 for forming a radiator 51. Preferably, said openings 78 are arranged as spaced from one another as two openings 69 of ducts 53 delimited by the tubular portions 52 of two adjacent heating elements 50.

[0117] . According to an embodiment, said manifold 74 has a body delimiting a duct 75 comprising at least one opening 78 adapted for connecting to a heating element 50, said opening 78 is delimited by a surface 88 adapted for cooperating with a sealing element 89, for example an O ring.

[0118] . According to an embodiment, said manifold 74 having a body delimiting a duct 75 comprises at least one opening 85, 86 transversal to said duct 75 for the connection of the manifold to a hydraulic system, or adapted for the connection to a closing cap 80.

[0119] . According to an embodiment, a junction element 90 is adapted for connecting a manifold 74, of fluid connection between a plurality of heating elements, to a duct 53 delimited by the tubular portion 52 of a heating element 50 (figures from 31 to 34, as well as 55 and 57).

[0120] . Advantageously, a junction element 90 comprises a tubular body having an annular enlargement 91 comprising opposed abutment surfaces 92 for a manifold 74 and respectively for a heating element 50 and respective opposed seats 93 for sealing means 89.

[0121] . According to an embodiment, a junction element 90 comprises a tubular end 94 adapted for being introduced and guided into an opening 78 of a manifold 74.

[0122] . According to a further embodiment, a junction element 90 comprises an opposed tubular end 95 adapted for being introduced and guided into an opening 69 of a duct 53 delimited by the tubular portion 52 of a heating element 50.

[0123] . According to an even further embodiment, a junction element 90 comprises an opposed tubular end 95 having outer surface 96 adapted for cooperating with the plurality of surfaces 66 of the free end of the longitudinal ribs 65 inside the tubular portion 52.

[0124] . Advantageously, a junction element 90 comprises opposed tubular ends 94 and 95 having outer guide and centring surfaces 96 and 97 for openings 78 and 69 of a manifold 74 and respectively of a heating element 50.

[0125] . According to an embodiment, a manifold locking element 98 is adapted for clamping a manifold 74 against at least one heating element 50 so that manifold 74 remains firmly in fluid connection with said heating element 50 (figures from 36 to 39 and 55, 57).

[0126] . Advantageously, said manifold locking element 98 comprises a body obtained by extrusion and with section substantially identical to that of a heating element 50. Preferably, said manifold locking element 98 is connected to a respective heating element 50 by screws or tie rods 99 seated into longitudinal holes 68 provided in ribs 67 external to the tubular portion 52 of the locking element 98 and engaged for clamping an interposed manifold 74 into corresponding longitudinal holes 68 of ribs 67 external to the tubular portion 52 of a respective heating element 50.

[0127] . According to an embodiment, a covering panel 100 comprises a plate-shaped body comprising on an inner face at least one longitudinal shaped rib 101, at least one of which being adapted for cooperating with at least one longitudinal channel 56 of a heating element 50 for its connection in at least partial covering thereof.

[0128] . Advantageously, said covering panel 100 comprises a body obtained by extrusion.

[0129] . According to an embodiment, said covering panel 100 comprises a plate-shaped body comprising on an inner face at least one rib 101 adapted for coupling snap-wise with a longitudinal seat 60 provided in at least one of said longitudinal channels 56 of the heating element 50.

[0130] . Advantageously, said covering panel 100 comprises a plate-shaped body comprising on an inner face at least one rib 102 with an abutment surface 103 adapted for abutting against the body of a heating element 50 to which said panel is connected.

[0131] . According to an embodiment, said covering panel 100 exhibits a longitudinal extension (h) equal to or shorter than the height of radiator 51 (figure 55).

[0132] . Preferably, said covering panel 100 exhibits a width (p) equal to half the width (L) of a heating element 50, or advantageously, a width (p) equal to the width (L) of a heating element 50, or advantageously, a width (p) equal to one and a half the width (L) of a heating element 50, or advantageously, a width (p) equal to twice the width (L) of a heating element.

[0133] . According to an embodiment, a plurality of covering panels 100 is comprised, adapted for entirely covering a side of radiator 51. Advantageously, a plurality of covering panels 100 is comprised, adapted for entirely covering two sides of radiator 51. Even more advantageously, a plurality of covering panels 100 is comprised, adapted for entirely covering three sides of radiator 51 or preferably, adapted for entirely covering four sides of radiator 51.

[0134] . According to an embodiment, a plurality of heating elements 50 sided to one another is connected to one another and firmly locked by at least one manifold 74 arranged transversally to the heating elements 50.

Preferably, a plurality of heating elements 50 sided to one another is connected to one another and firmly locked by at least two manifolds 74 arranged transversally both on top and at the bottom of the heating elements 50.

[0135] . According to an embodiment, at least one alignment pin 62 is provided between two heating elements 50 sided to one another, with ends thereof seated into facing longitudinal channels 56 of the sided heating elements 50. Advantageously, at least one alignment pin 62 is provided between two heating elements 50 sided to one another, comprising snap-wise coupling means 105 with one of the two facing longitudinal channels 56 of said sided heating elements 50, and opposed side 106 free of guiding the facing longitudinal channel 56 of the opposed heating element 50.

[0136] . According to an embodiment, an accessory connection element 59 is connected to a heating element 50 by fixing means 106. Advantageously, an accessory connection element 59 is connected by self-threading screws 106 to at least one longitudinal channel 56 of a heating element 50.

[0137] . According to an embodiment, on top of the radiator there are provided covering closing grids 107 adapted for the free air circulation, heated by the underlying heating elements 50. Advantageously, said closing grids 107 are provided with a baffle 108 adapted for conveying the air that touches the support wall 109 of radiator 51 towards said grids.

[0138] . According to an embodiment, a support plate 57, 58 is laterally fixed to at least one heating element 50, adapted for the connection of the radiator to a support wall 109. Advantageously, a support plate 58 is laterally fixed to at least one heating element 50, comprising a pin end 110 adapted for being seated in a seat 111 of a plate 112 fixed to the support wall 109 for the free rotation of the pin end 110 and the consequent swing of the radiator away from said support wall 109 (figure 62).

[0139] . According to an embodiment, a radiator 51 comprises a plurality of heating elements 50 in fluid connection by a pair of manifolds 74 arranged as a joint of the end openings 69 of ducts 53 of said heating elements 50, wherein the remaining openings of the manifolds are closed by caps 80 except for two connection openings in inlet from a hydraulic circuit and respectively in outlet towards said hydraulic circuit (figures from 64 to 69, where the openings closed by a cap are schematically indicated with symbol X and those adapted for the fluid inlet are indicated with an ingoing arrow whereas those adapted for the fluid outlet are indicated with an outgoing arrow).

[0140] . Advantageously, said inlet and outlet opening of the manifolds is an end opening of a same manifold.

[0141] . Preferably, said inlet opening is an end opening of a first manifold and said outlet opening is an end opening of a second manifold (figures 64, 65, 66, 67).

[0142] . According to an embodiment, said inlet and outlet opening of the manifolds are two cross openings

of a same manifold (figures 68 and 69).

[0143] . Thanks to the particular structure with longitudinal development of its heating elements, the radiator according to the present invention exhibits a high thermal efficiency and can also be easily adapted and/or modified by cutting the heating elements to the appropriate size and connecting them to one another. With this device, a radiator having both vertical and horizontal modularity can be obtained.

[0144] . The heating elements and/or the front covers are preferably made of a single piece of extruded material, in particular aluminium or its alloys, so that their manufacture is simple and inexpensive.

[0145] . Moreover, the heating elements and/or their front covers are provided with particular longitudinal channels and ribs that improve the heat exchange and also simplify the screw or snap-wise fixing to one another and/or to connection accessories.

[0146] . Thanks to their particular structure and size, also the front covers can be cut to the desired size and easily applied to the heating elements, so as to obtain several front covering effects, each with a pleasant aesthetic appearance. These particular front covers further allow easy and quick application of accessories to the radiator and they can even be adapted for thermally insulating the front radiator surface.

[0147] . The radiator can be connected to a heating system by special joints that are easy to apply to the heating elements or to the manifolds and allow several types of connections in different directions, so as to further improve the adaptability of the radiator.

[0148] . A man skilled in the art may make several changes, adjustments and replacements of elements with other functionally equivalent ones to the preferred embodiment of the heating element described, in order to meet specific and incidental needs, without departing from the scope of the following claims.

Claims

1. A heating element for radiators, comprising a modular body, said body being obtained by extrusion with longitudinal extension and shaped cross section, said body comprising:

a tubular portion internally delimiting a duct for the circulation of a heating fluid;
a plurality of longitudinal fins that extend from said tubular portion;
branches that extend from at least one of said longitudinal fins;

wherein

at least one of said branches delimits at least one longitudinal channel;

at least one of said longitudinal channels being suitable:

- for the connection of at least one second modular body of a heating element, or
- for the connection of at least one fixing element, or
- for the connection of at least one accessory;

and wherein said tubular portion, said at least one plurality of fins and said branches are in a single piece.

2. A heating element according to claim 1, wherein said at least one of said longitudinal channels comprises a portion forming a snap-wise coupling seat.
3. A heating element according to any one of the previous claims, wherein at least two longitudinal channels are opposed to one another.
4. A heating element according to any one of the previous claims, wherein there are provided at least two opposed longitudinal channels adapted for the connection of the heating element to an adjacent heating element.
5. A heating element according to any one of the previous claims, wherein said body and said longitudinal fins and said branches, in a plane transversal to said body, exhibit an overall dimension fully inscribable in a rectangle.
6. A heating element according to any one of the previous claims, wherein said body comprises a cross section specularly symmetrical relative to a median axis.
7. A heating element according to any one of the previous claims, wherein said body comprises a cross section specularly symmetrical relative to an axis transversal to a median axis.
8. A heating element according to any one of the previous claims, wherein longitudinal ribs extend internally from the inner surface of said tubular portion.
9. A heating element according to any one of the previous claims, wherein longitudinal ribs comprising a guide surface at the free end extend internally from the inner surface of said tubular portion.
10. A heating element according to any one of the previous claims, wherein said tubular portion externally comprises at least one longitudinal rib.
11. A heating element according to any one of the pre-

vious claims, wherein said tubular portion externally comprises at least one longitudinal rib comprising at least one longitudinal hole.

12. A heating element according to any one of the previous claims, wherein said tubular portion comprises at the end a duct opening delimited by a sealing and abutment surface.
13. A heating element according to any one of the previous claims, wherein at least one of said arms extends in substantially radial direction from said tubular portion.
14. A heating element according to any one of the previous claims, wherein at least one pair of said arms extends from said tubular portion in opposed directions remaining substantially on a same median plane orthogonal to the cross section of said body.
15. A heating element according to any one of the previous claims, wherein at least one pair of said arms extends from said tubular portion substantially forming a V shape.
16. A heating element according to any one of the previous claims, wherein at least one pair of said arms extends from said tubular portion substantially forming a V shape within which a third arm with two branches is comprised substantially forming a Y shape.
17. A heating element according to any one of the previous claims, wherein a plurality of branches extends in cross section to said body from at least one arm according to a direction transversal to a symmetry axis of said section.
18. A heating element according to any one of the previous claims, wherein at least one of said branches comprises a substantially localised enlargement.
19. A radiator comprising at least one heating element according to any one of claims from 1 to 18.
20. A radiator according to any one of claims from 19 to the previous one, wherein said manifold comprises at least two openings in the side facing the heating elements adapted for the fluid connection with the ducts delimited by the tubular portions of the heating elements, so as to obtain a fluid path or circuit between a first of said heating elements and at least one second of said heating elements.
21. A radiator according to any one of claims from 19 to the previous one, comprising a junction element adapted for connecting a manifold for fluid connection between a plurality of heating elements, to the

duct delimited by the tubular portion of a heating element.

22. A radiator according to any one of claims from 19 to the previous one, wherein a junction element comprises a tubular body having an annular enlargement comprising opposed abutment surfaces for a manifold and respectively for a heating element and respective opposed seats for sealing means.
23. A radiator according to any one of claims from 19 to the previous one, wherein a junction element comprises opposed tubular ends having outer guide and centring surfaces for openings of a manifold and respectively of a heating element.
24. A radiator according to any one of claims from 19 to the previous one, comprising a manifold locking element adapted for clamping a manifold against at least one heating element so that the manifold remains firmly in fluid connection with said heating element.
25. A radiator according to any one of claims from 19 to the previous one, comprising a covering panel comprising a plate-shaped body comprising on an inner face at least one longitudinal shaped rib, adapted for cooperating with at least one longitudinal channel of a heating element for its connection in at least partial covering thereof.
26. A radiator according to any one of claims from 19 to the previous one, comprising a covering panel comprising a plate-shaped body comprising on an inner face at least one rib adapted for coupling snap-wise with a longitudinal seat provided in at least one of said longitudinal channels of the heating element.
27. A radiator according to any one of claims from 19 to the previous one, wherein a plurality of heating elements sided to one another is connected to one another and firmly locked by at least two manifolds arranged transversally both on top and at the bottom of the heating elements.
28. A radiator according to any one of claims from 19 to the previous one, wherein a support plate is laterally fixed to at least one heating element, comprising a pin end adapted for being seated in a seat of a plate fixed to the support wall for the free rotation of the pin end and the consequent swing of the radiator away from said support wall.
29. A radiator according to any one of claims from 19 to the previous one, comprising a plurality of heating elements in fluid connection by a pair of manifolds arranged as a joint of the end openings of the ducts of said heating elements, wherein the remaining

openings of the manifolds are closed by caps except for two connection openings in inlet from a hydraulic circuit and respectively in outlet towards said hydraulic circuit.

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- 30.** A radiator comprising at least one heating element according to any one of claims from 1 to 18, wherein said heating element includes a first plate (1) connected to at least one duct (2) for a heating fluid, wherein a plurality of longitudinal fins (3, 4) protrudes from the front and/or rear surface of the plate (1), which is provided with one or more longitudinal channels (5, 6) that can seat screws for connecting the heating element to other heating elements, to fixing elements (19, 27) and/or to connection accessories (22, 23).

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- 31.** A radiator according to the previous claim, wherein the ducts (2) of the heating elements are connected to one another by pipes (21) having the ends provided with joints (22) inserted in the holes (9) obtained in the respective diaphragms (8).

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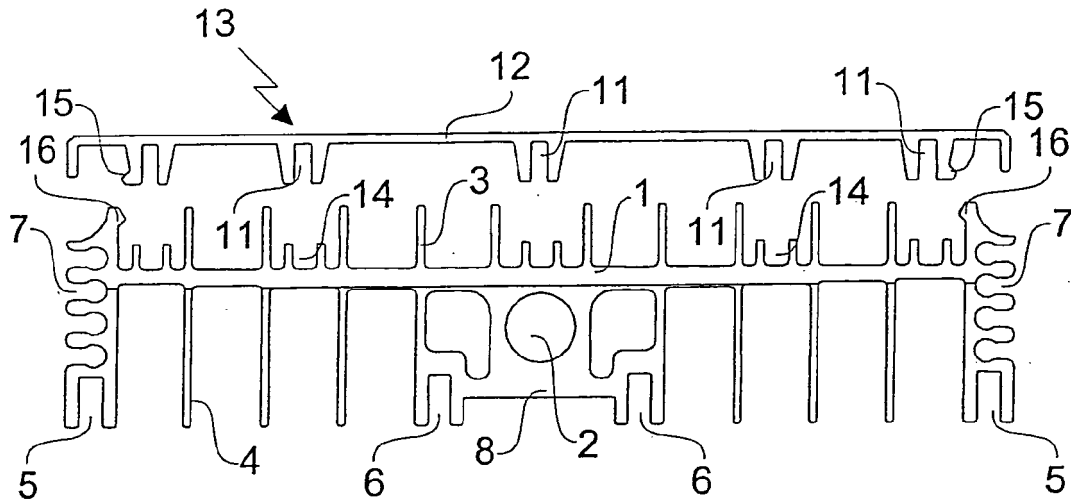


Fig. 1

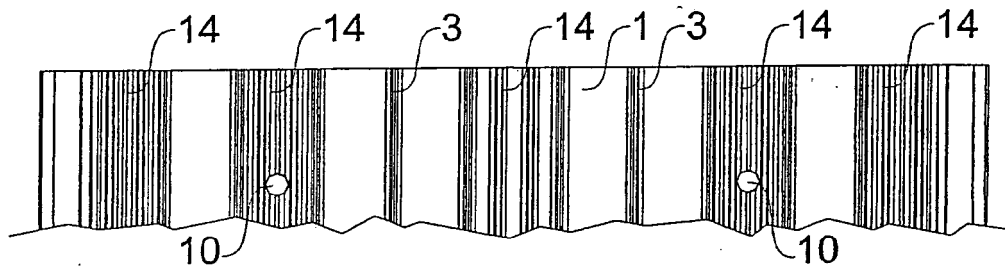


Fig. 2

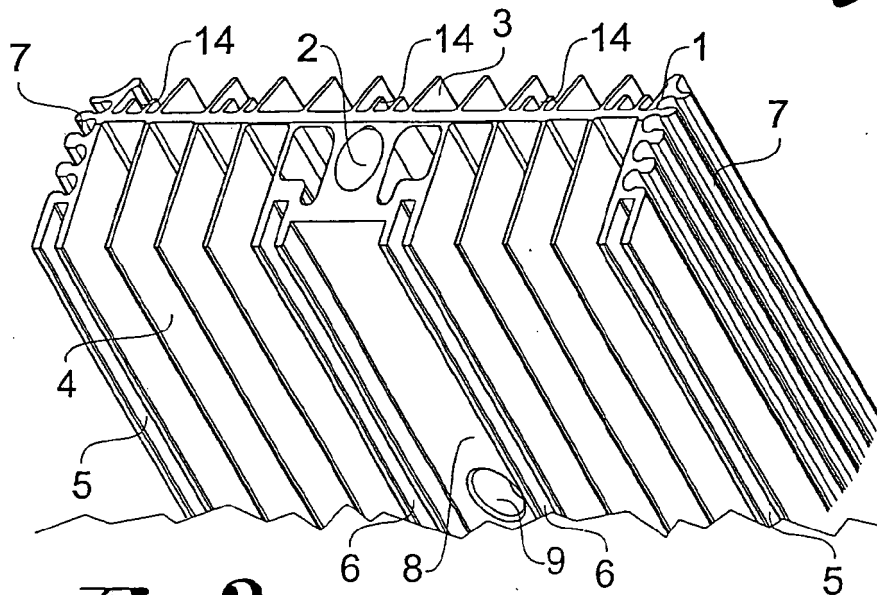


Fig. 3

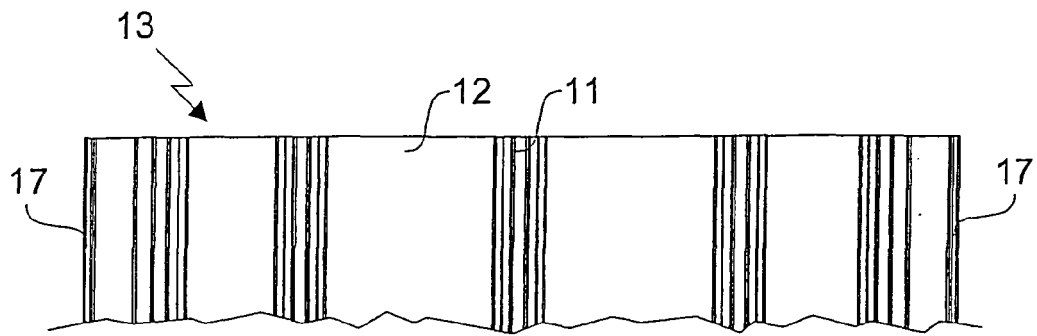


Fig. 4

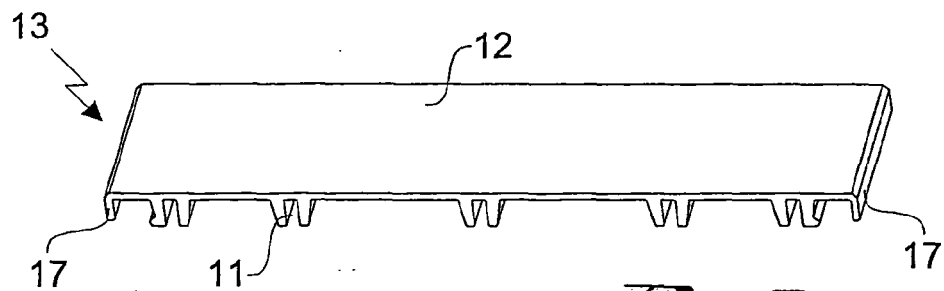


Fig. 5

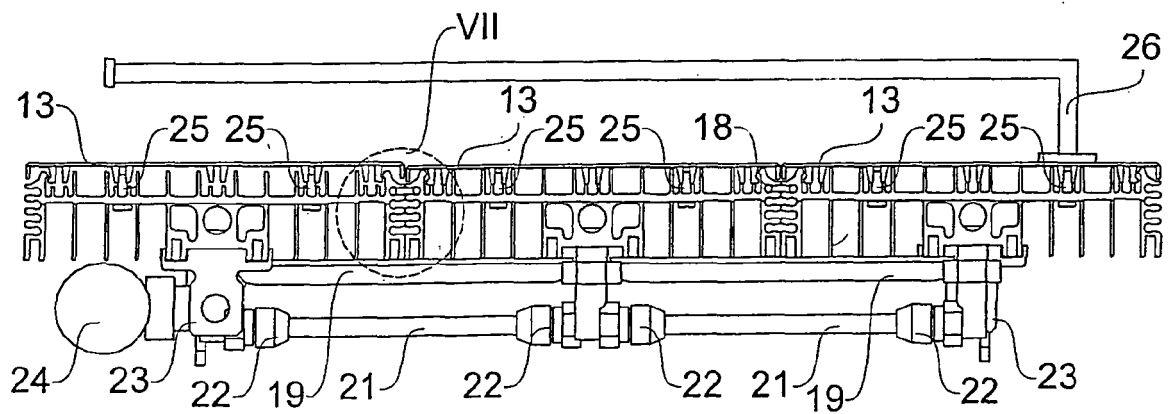


Fig. 6

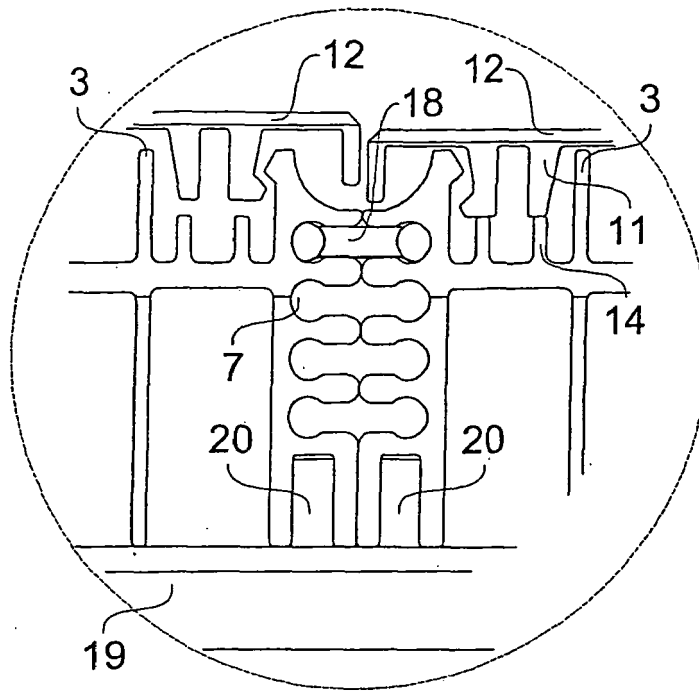


Fig. 7

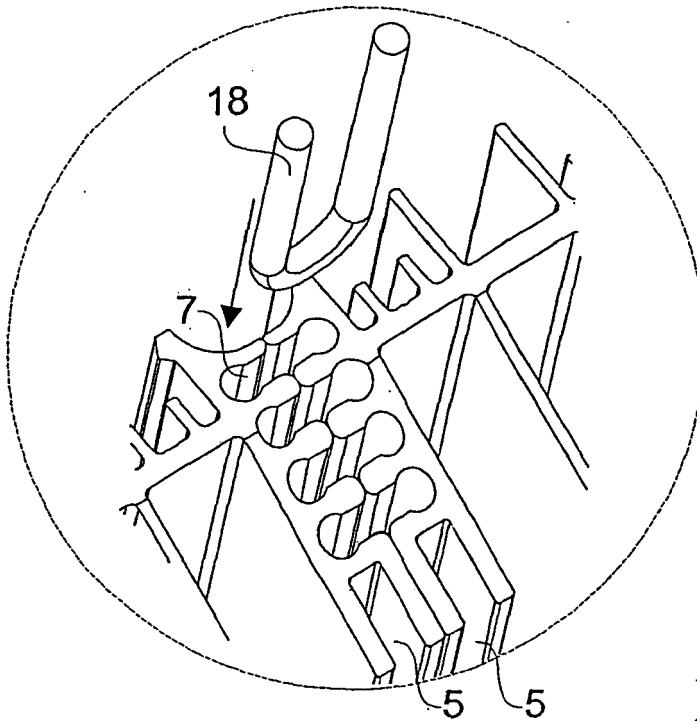


Fig. 8

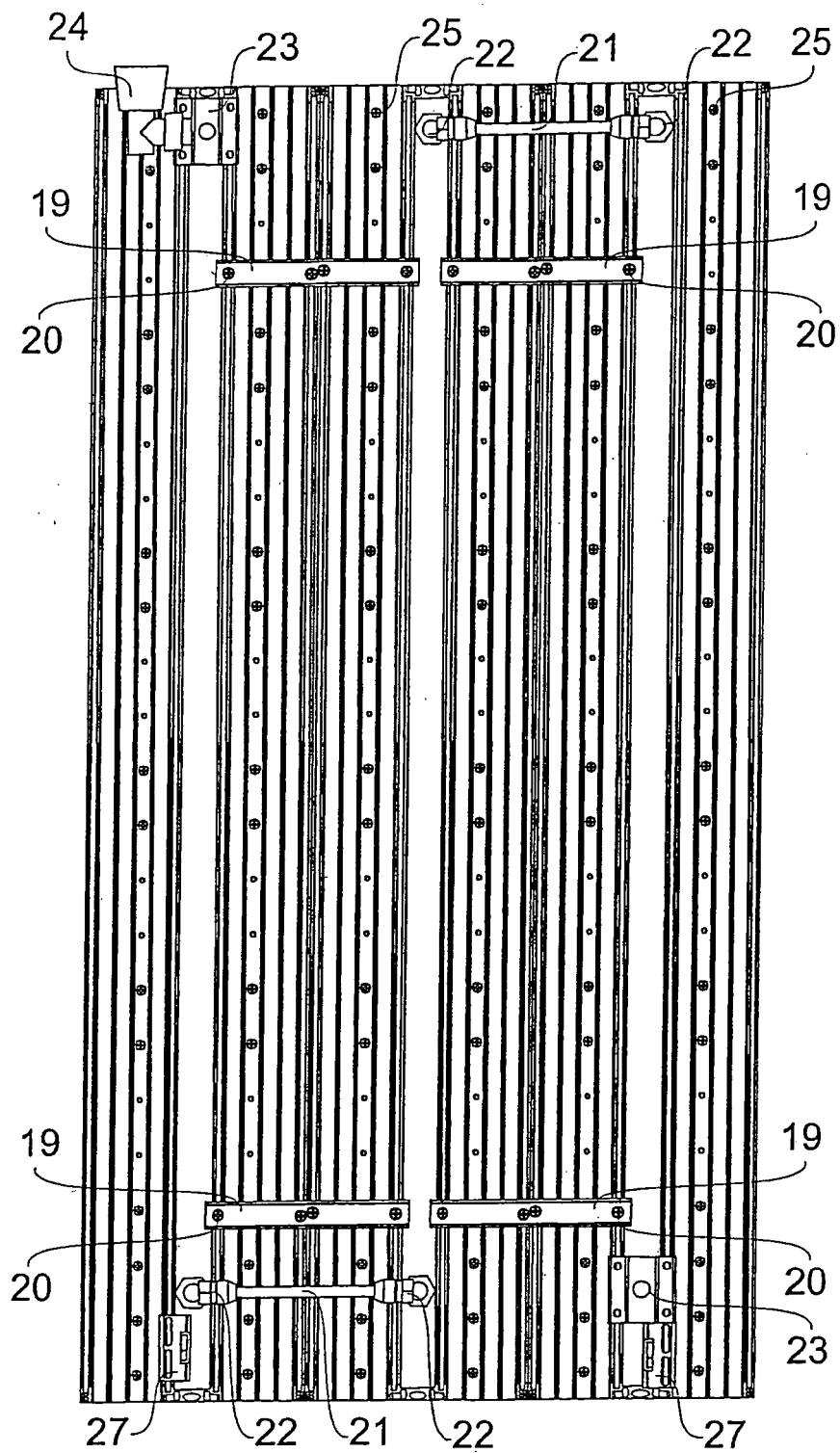


Fig. 9

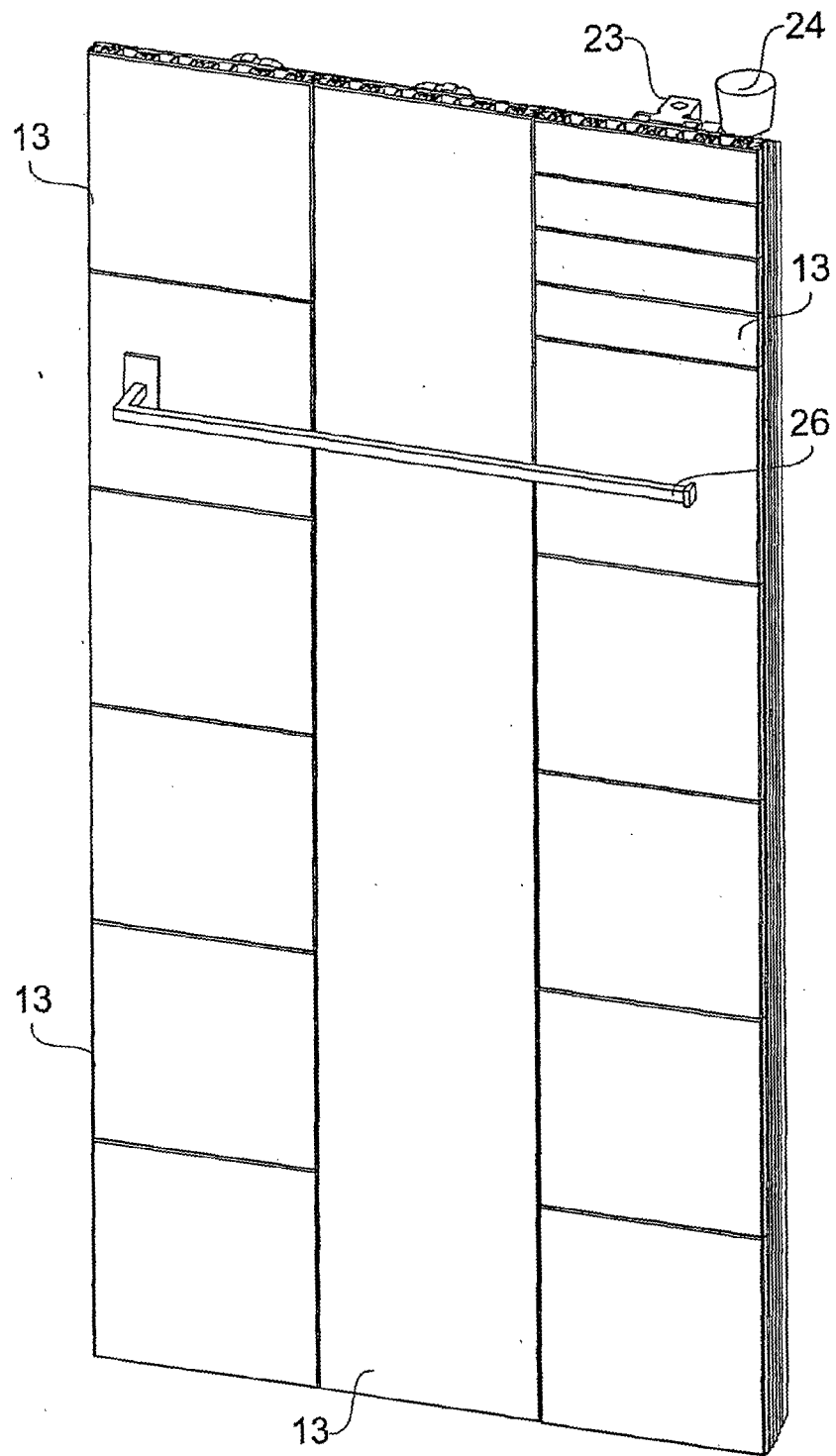


Fig. 10

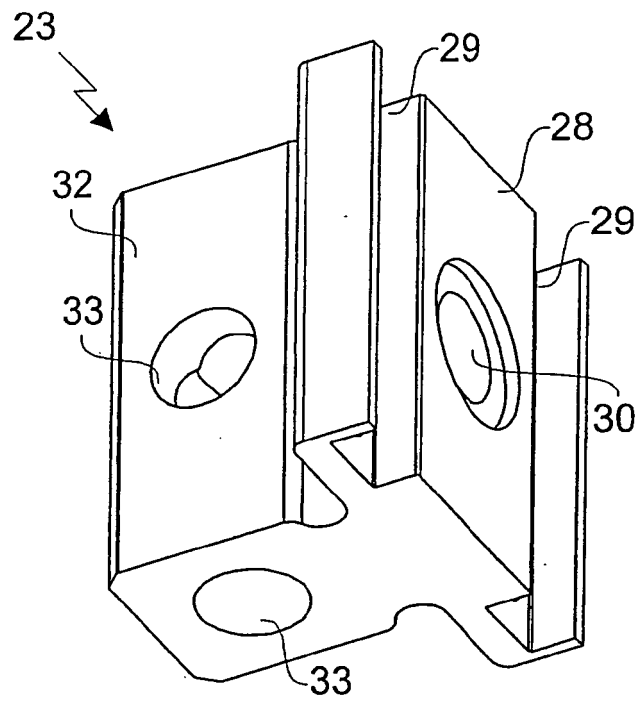


Fig. 11

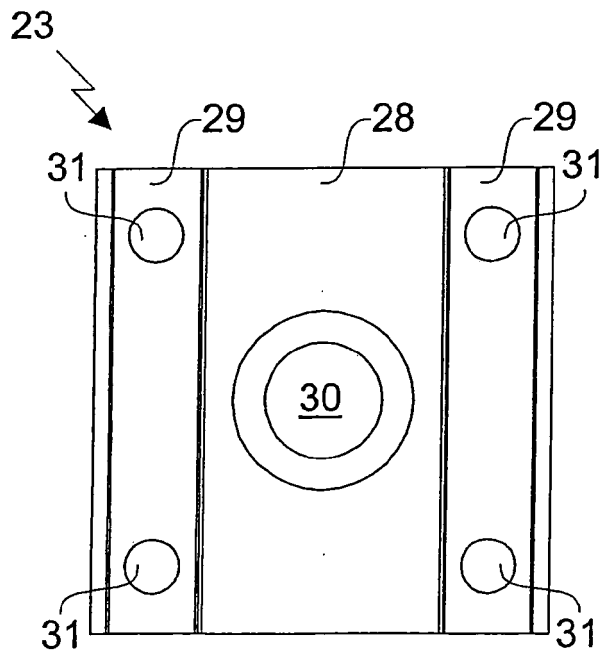


Fig. 12

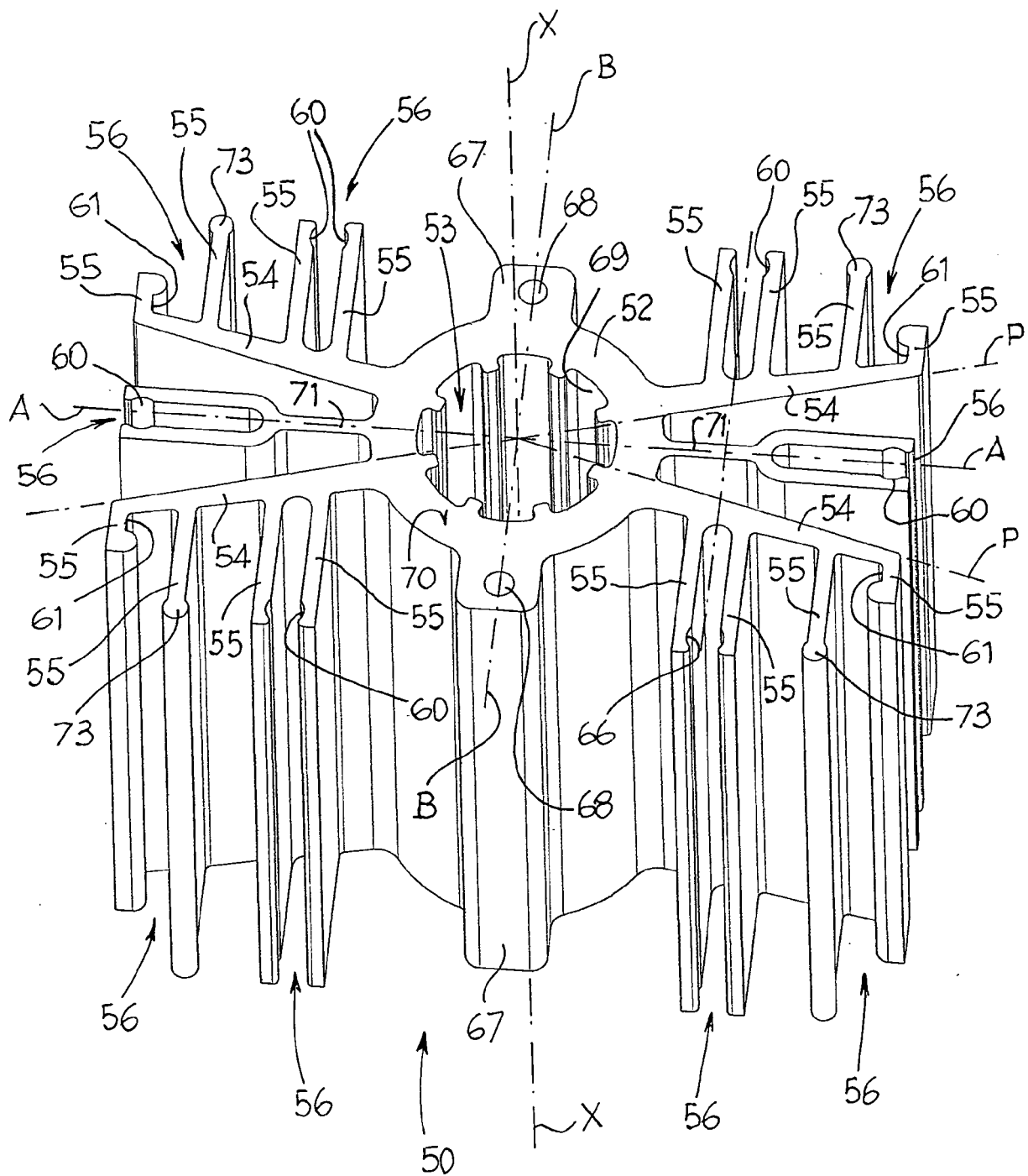
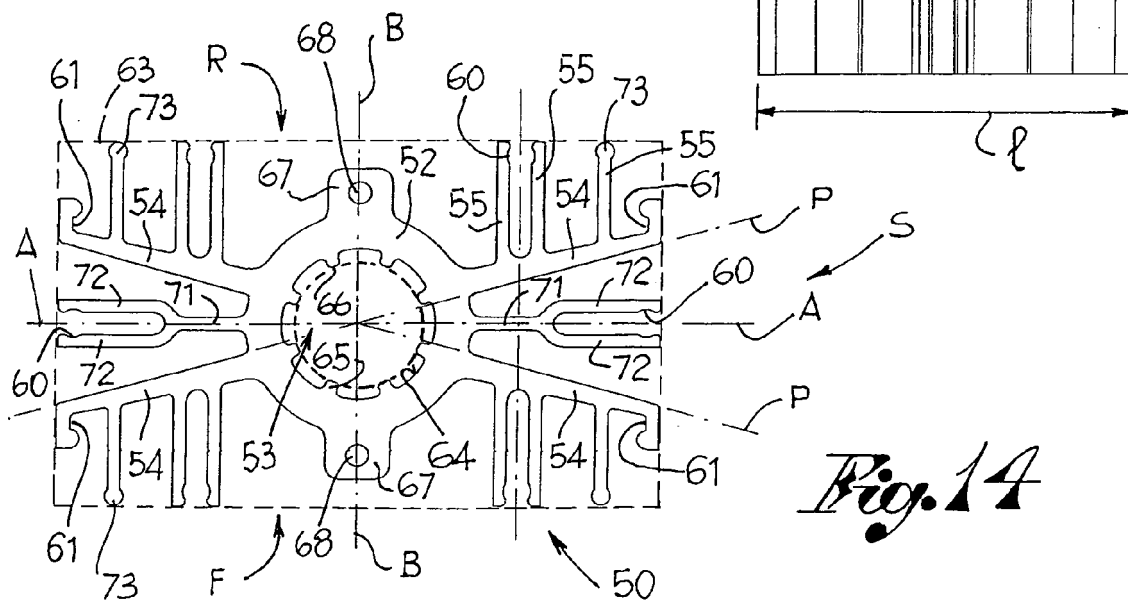
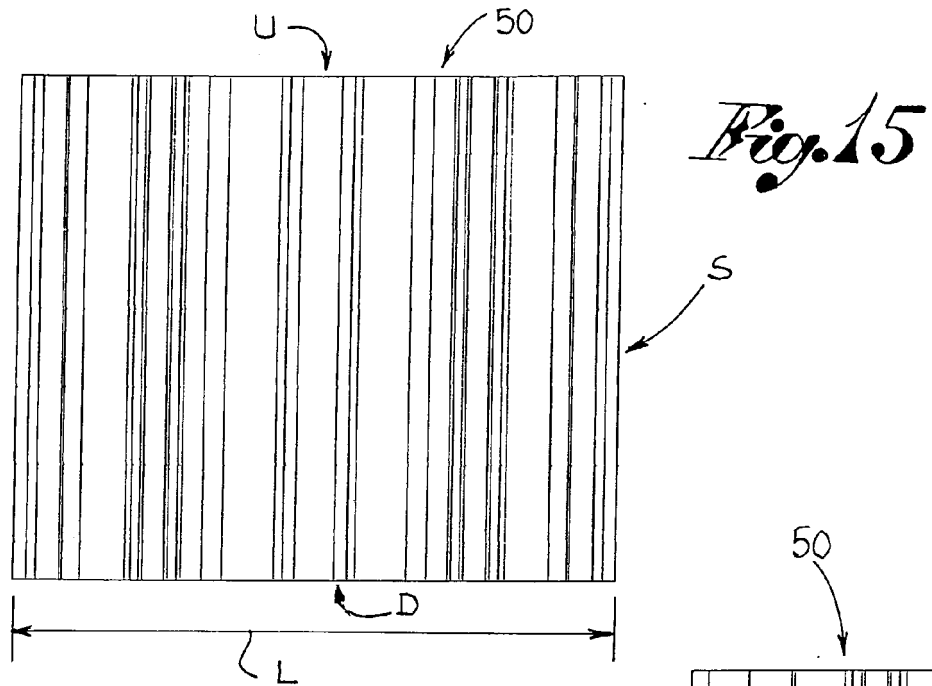


Fig. 13



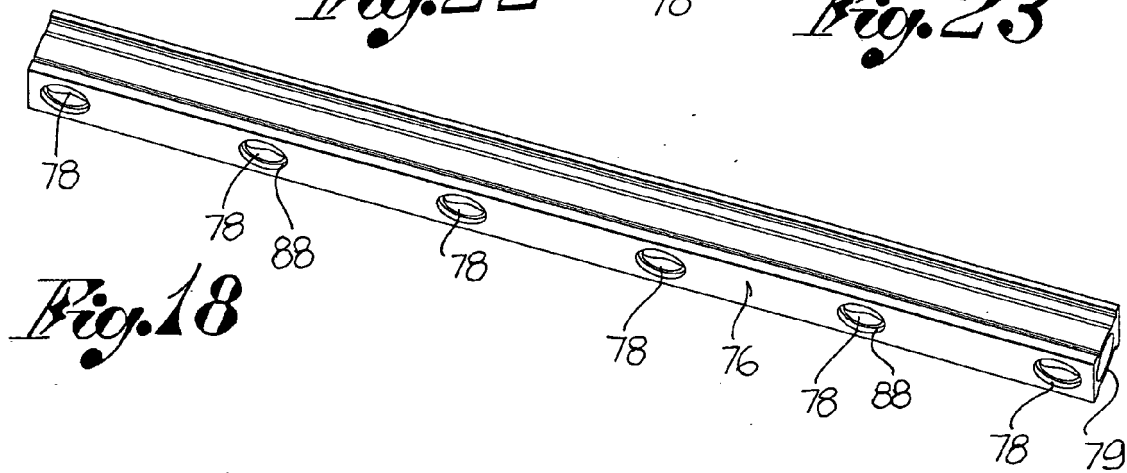
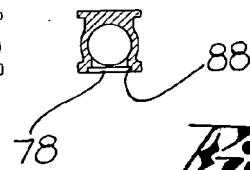
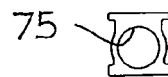
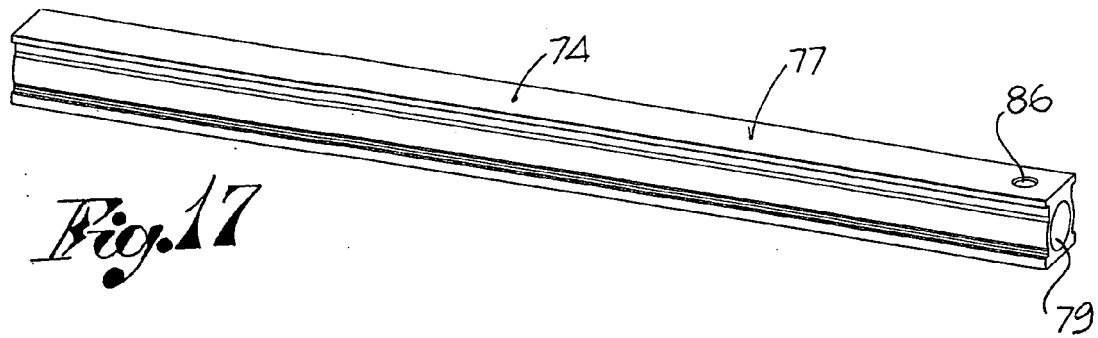


Fig. 19

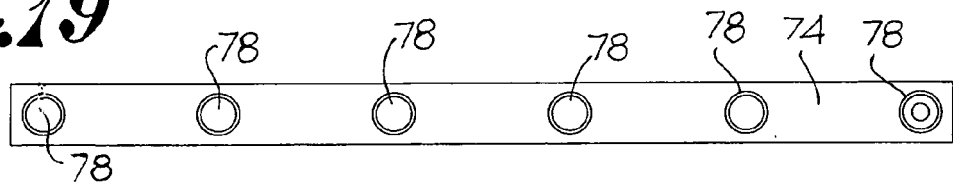


Fig. 20

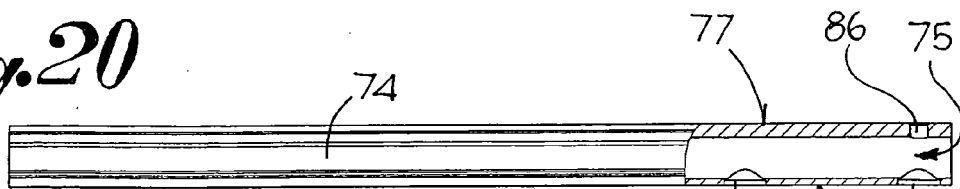
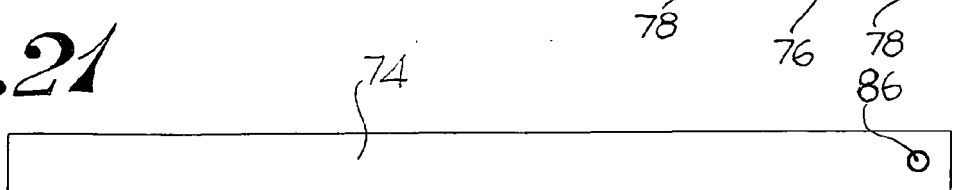


Fig. 21



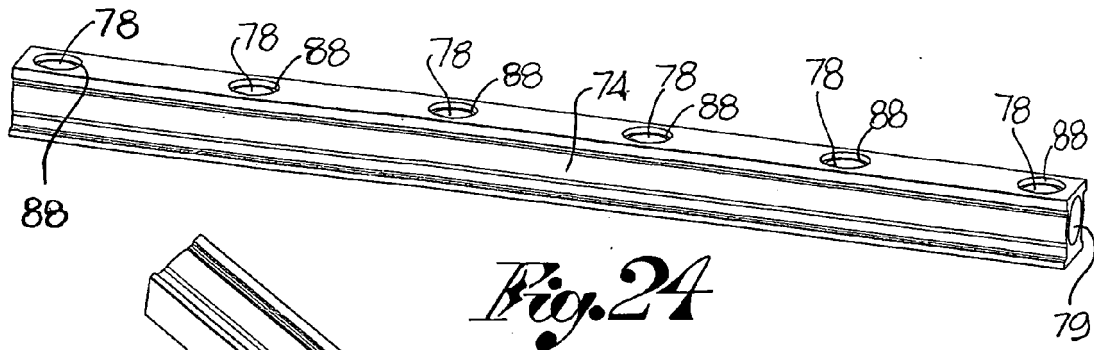


Fig. 25

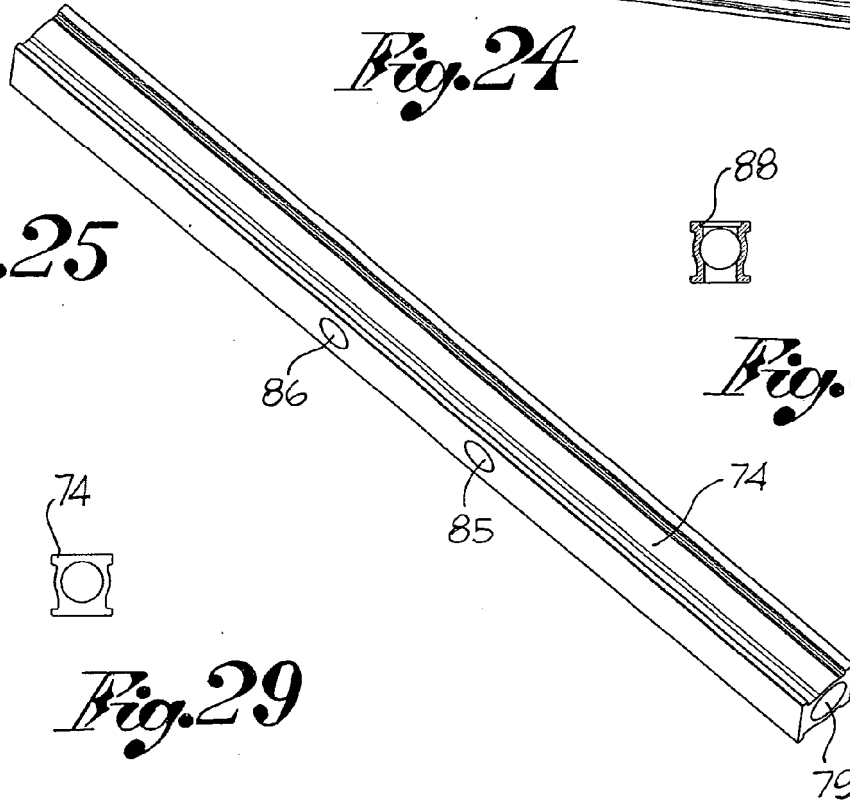


Fig. 26

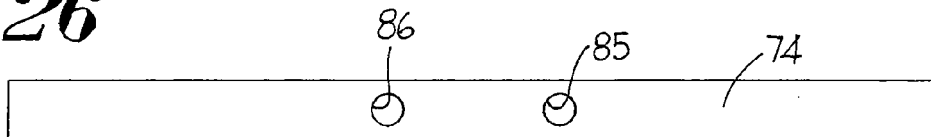


Fig. 27

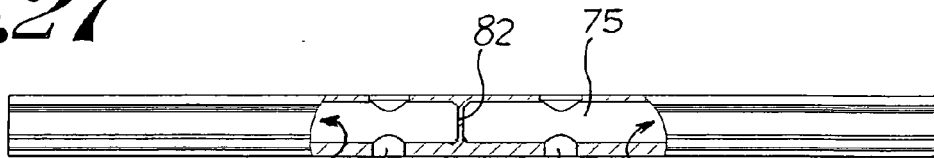
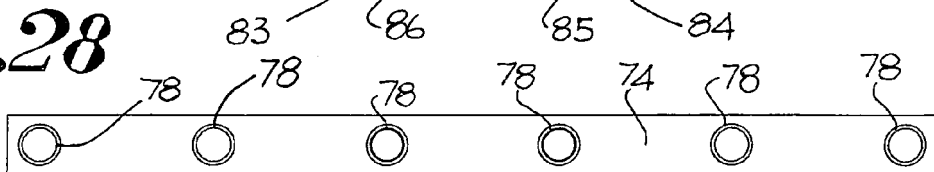


Fig. 28



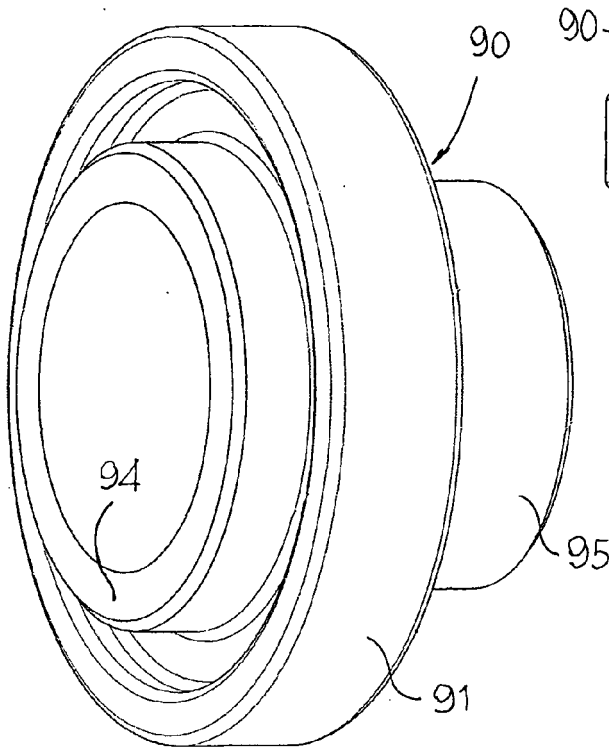


Fig. 31

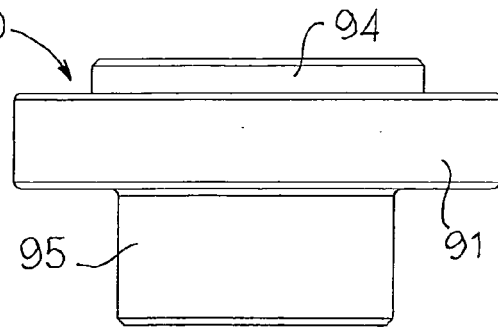


Fig. 33

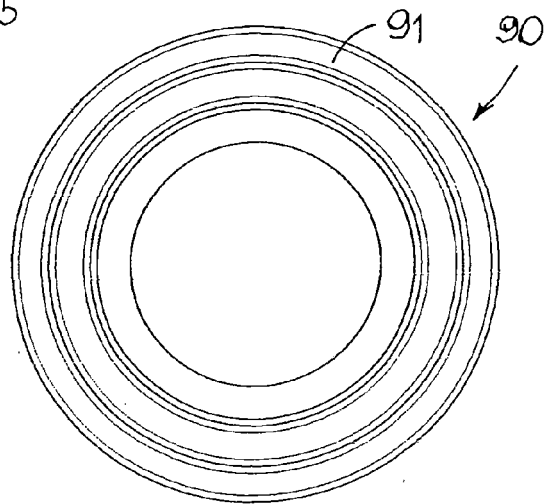


Fig. 34

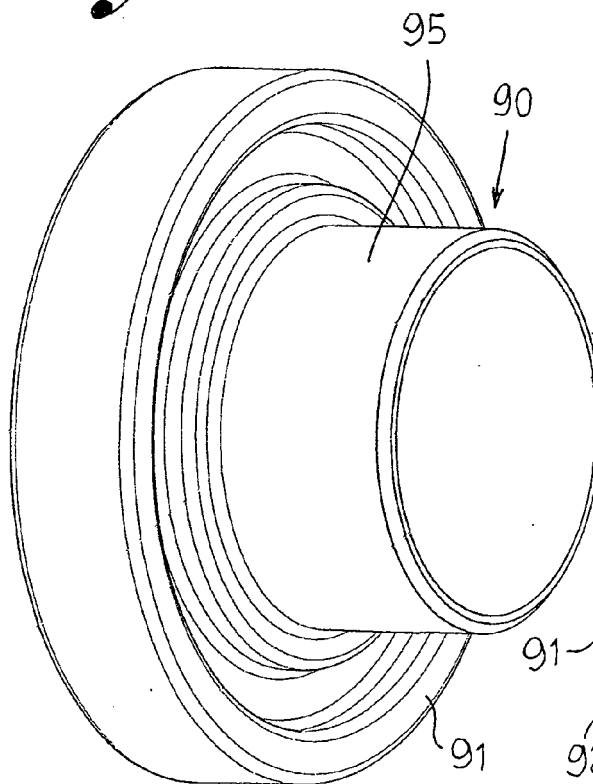


Fig. 32

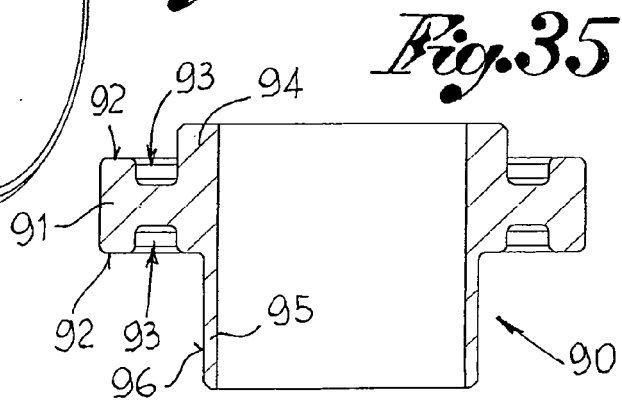
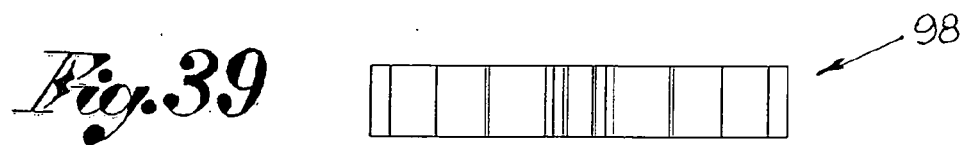
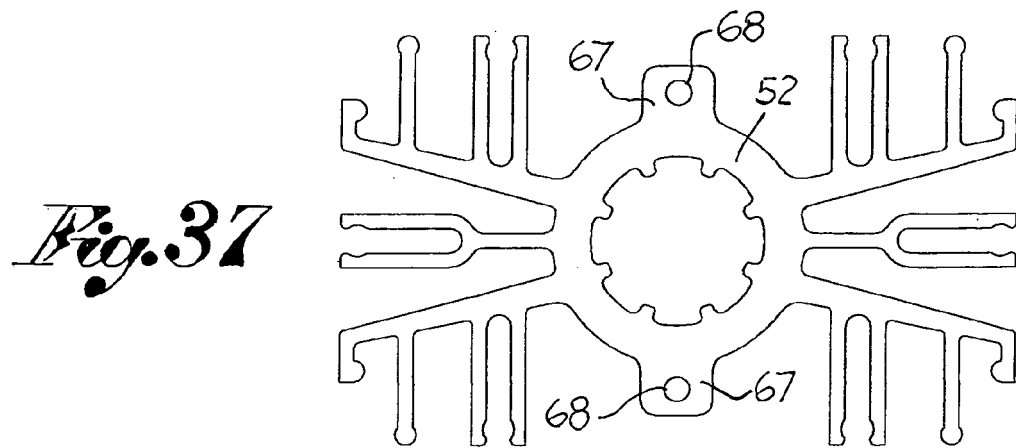
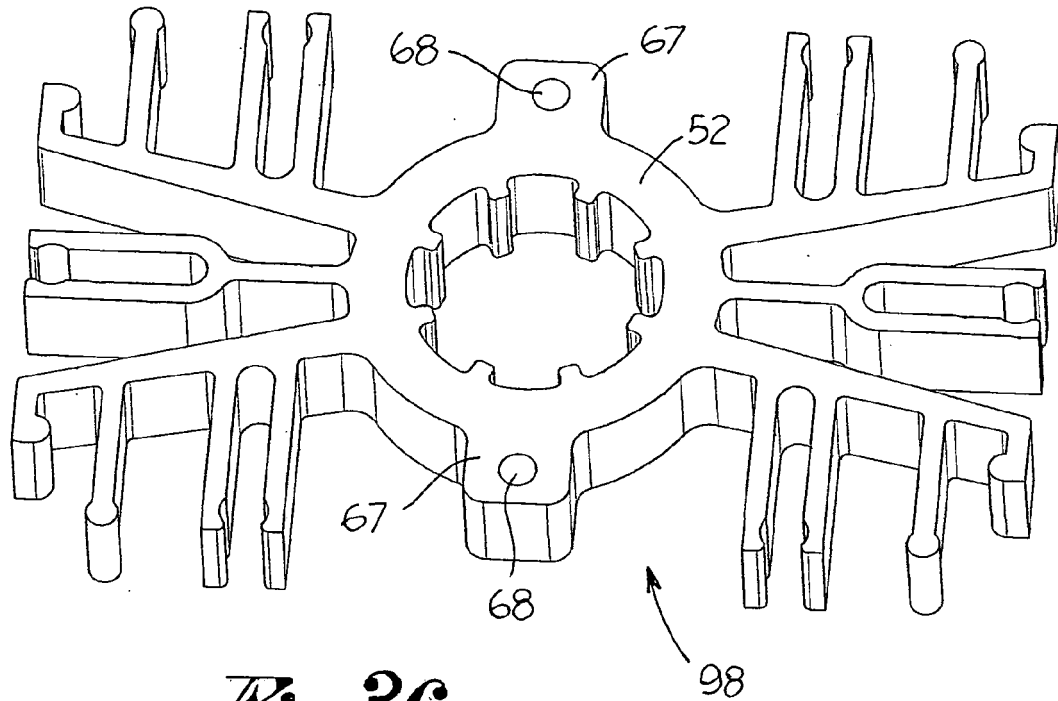
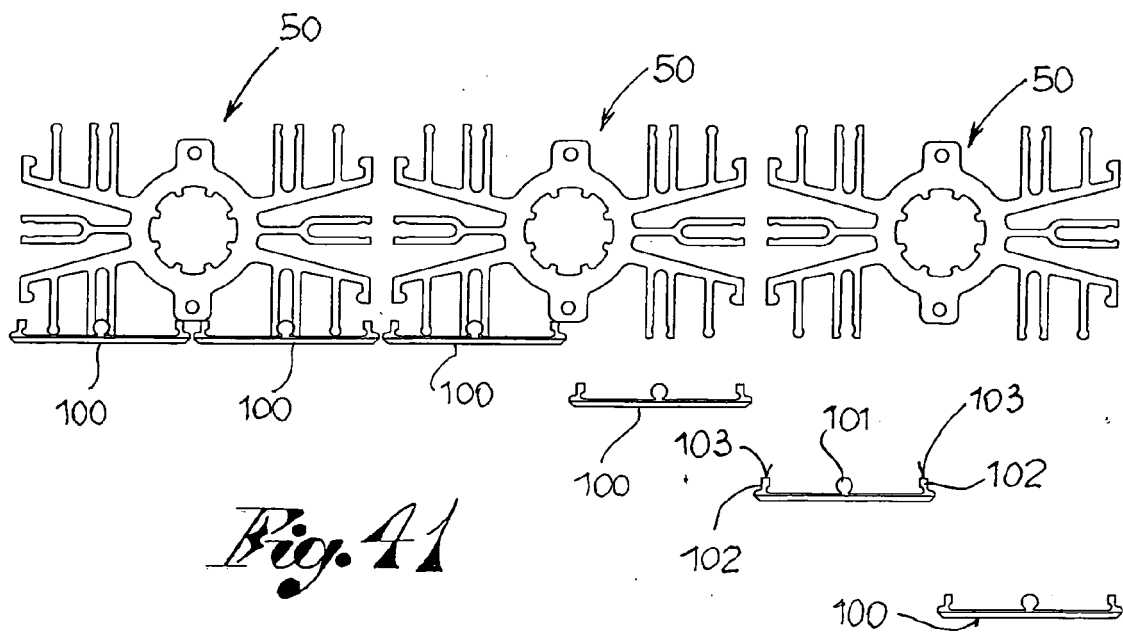
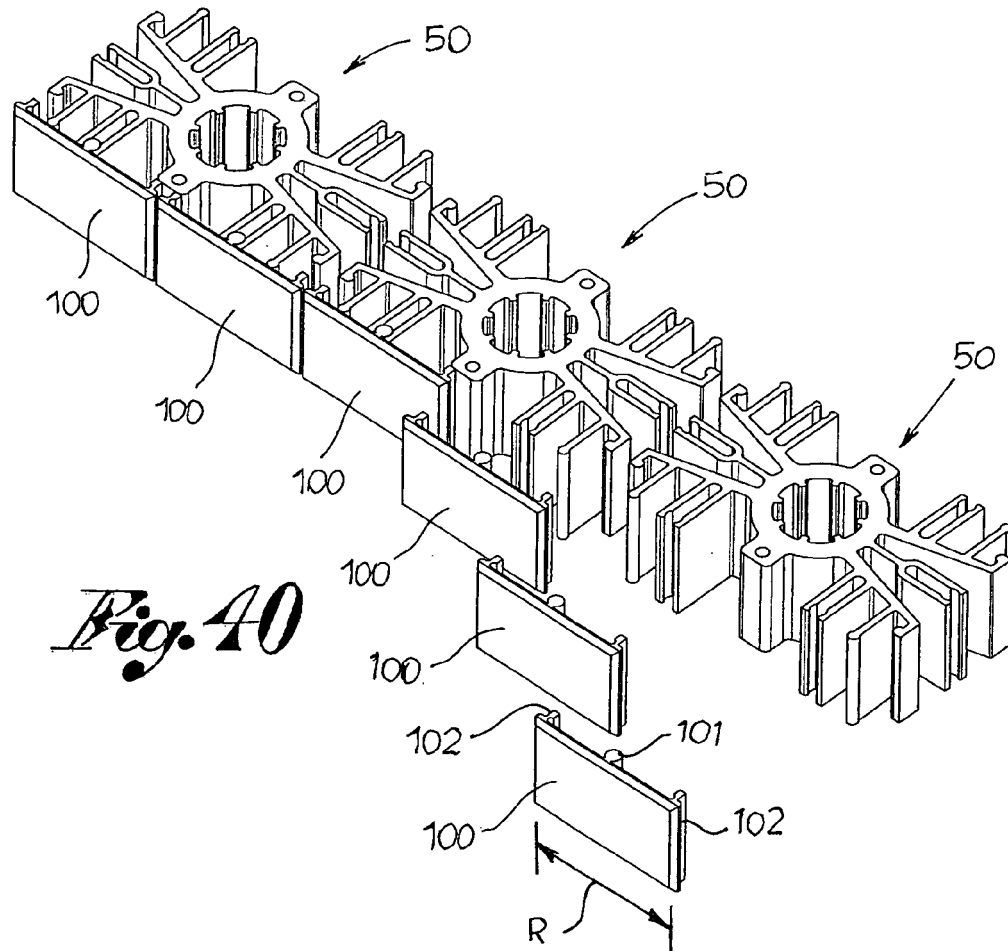
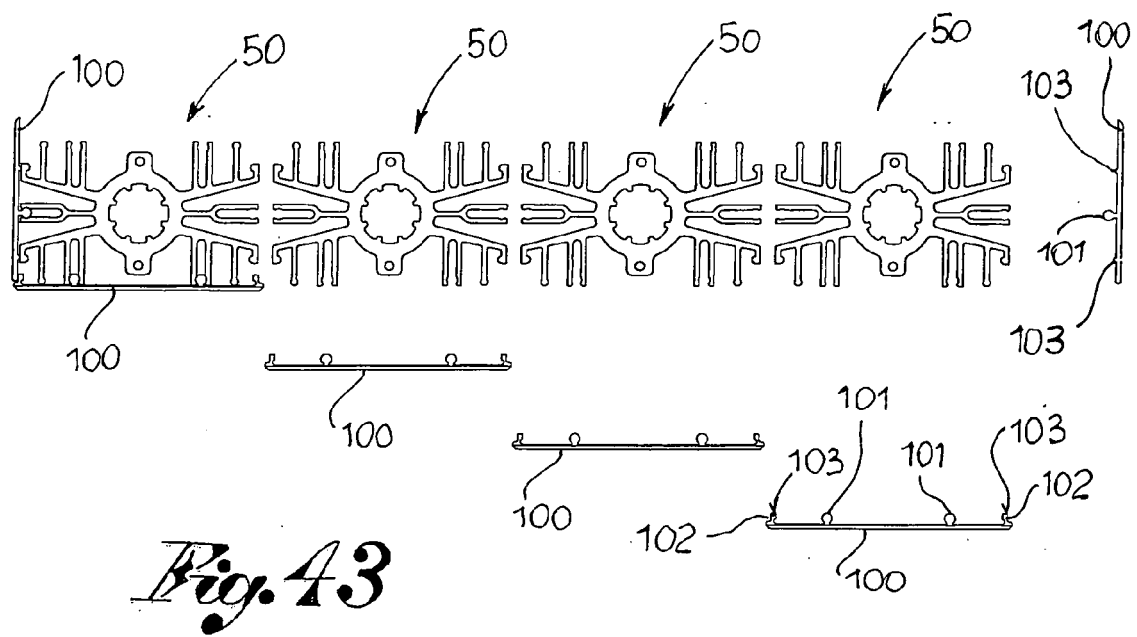
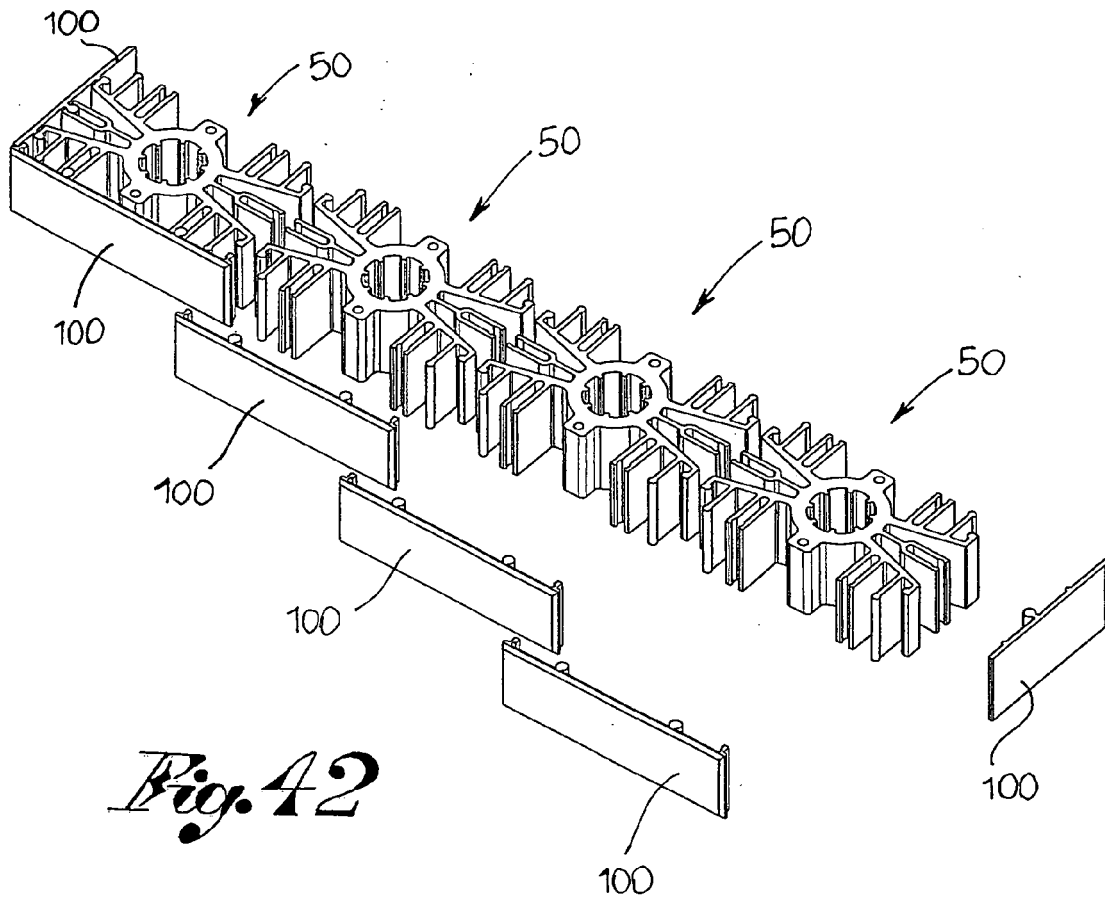


Fig. 35







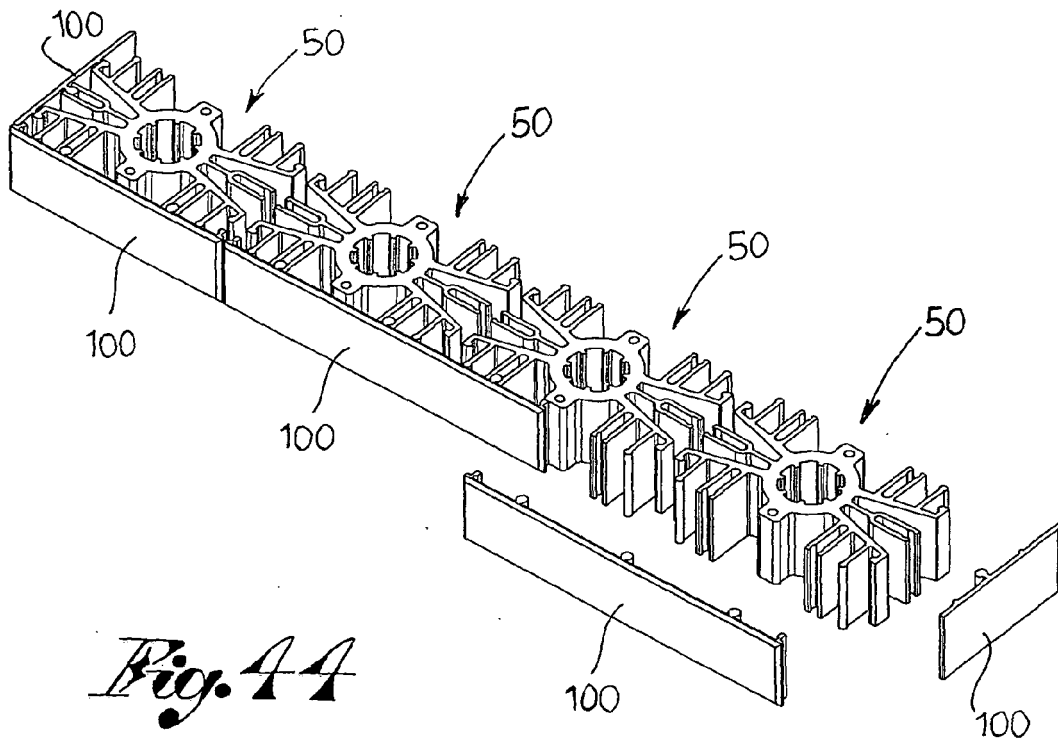


Fig. 44

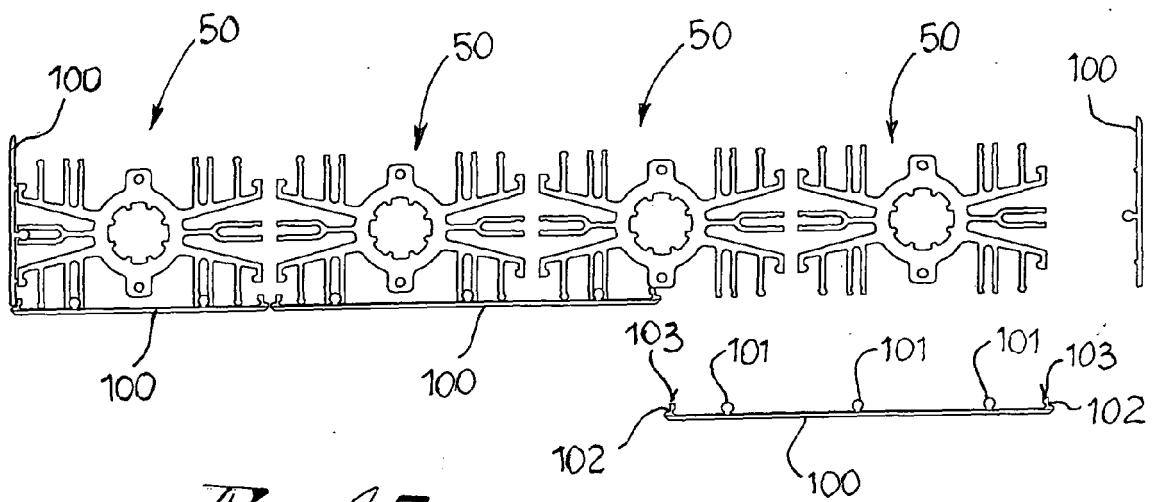
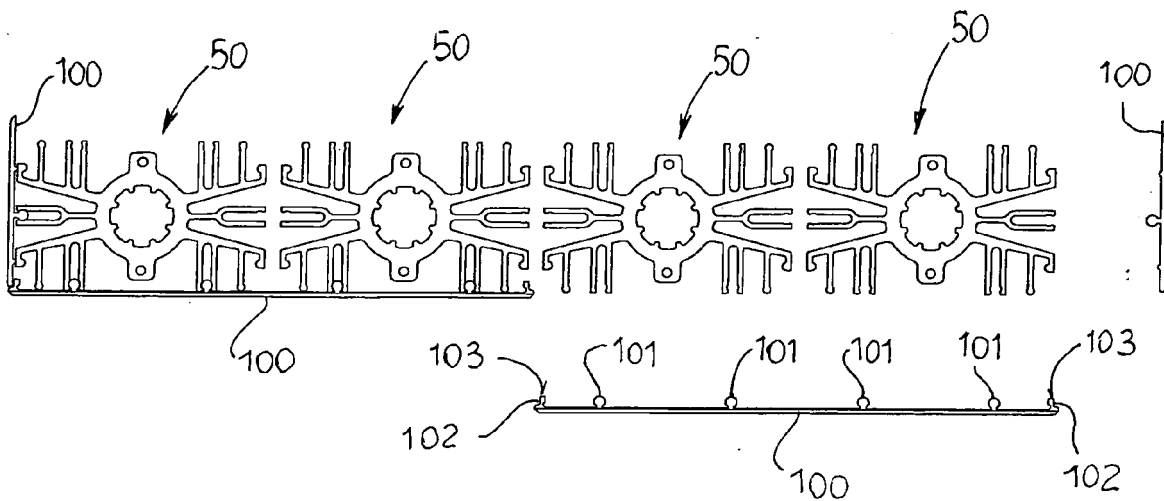
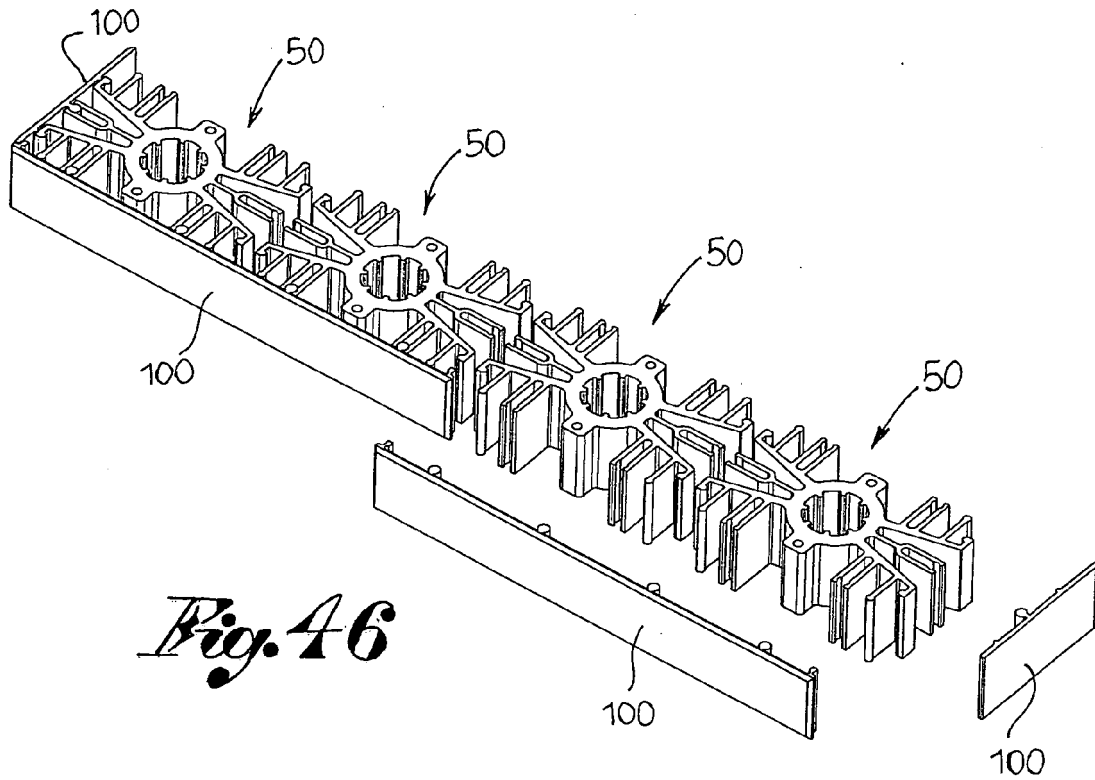
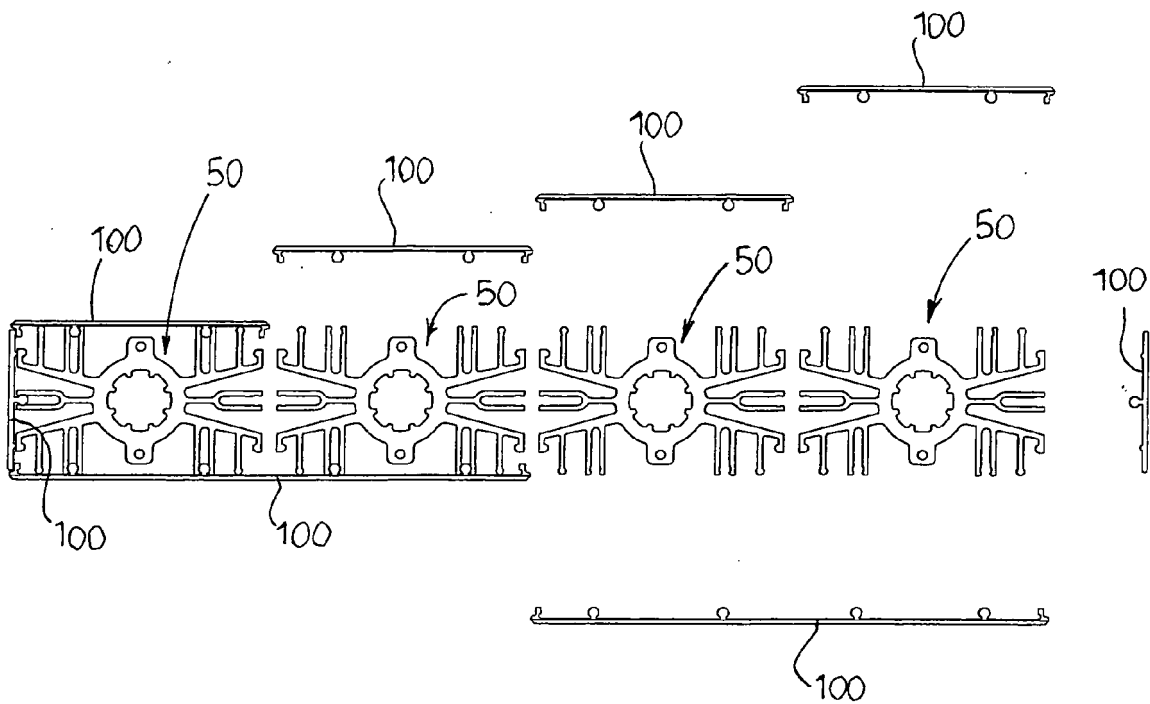
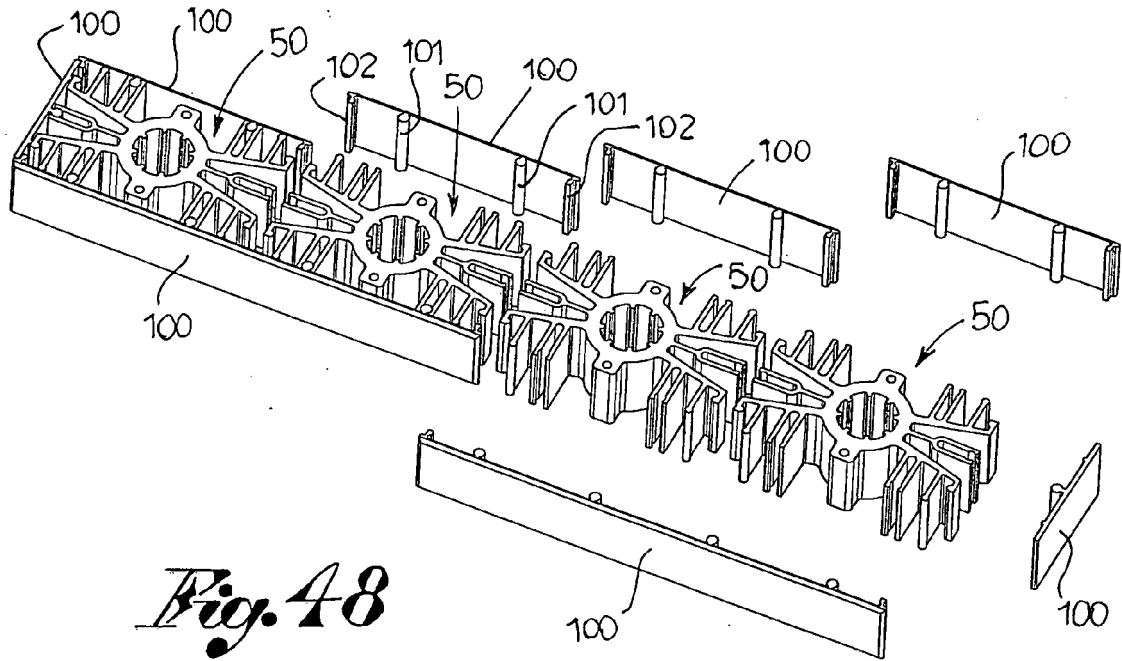
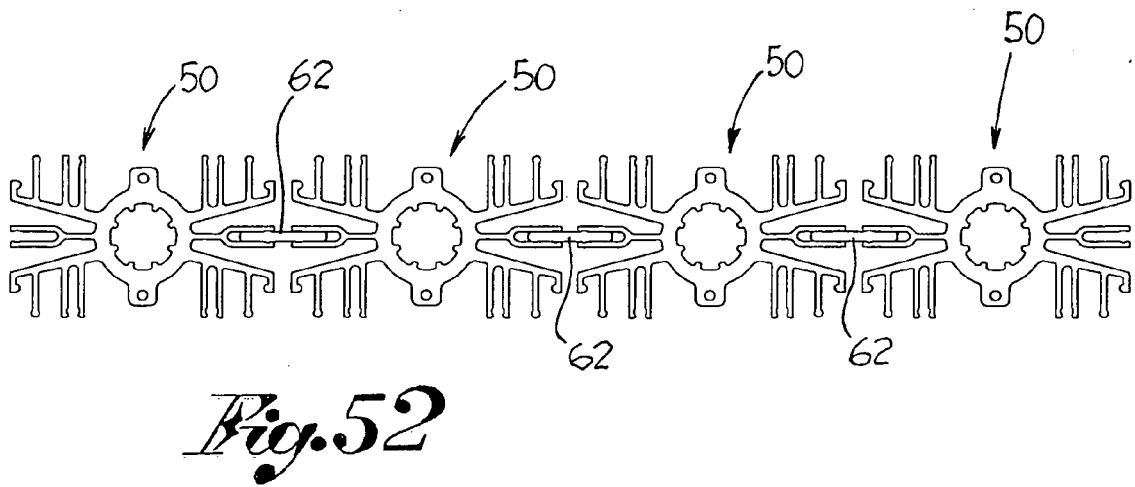
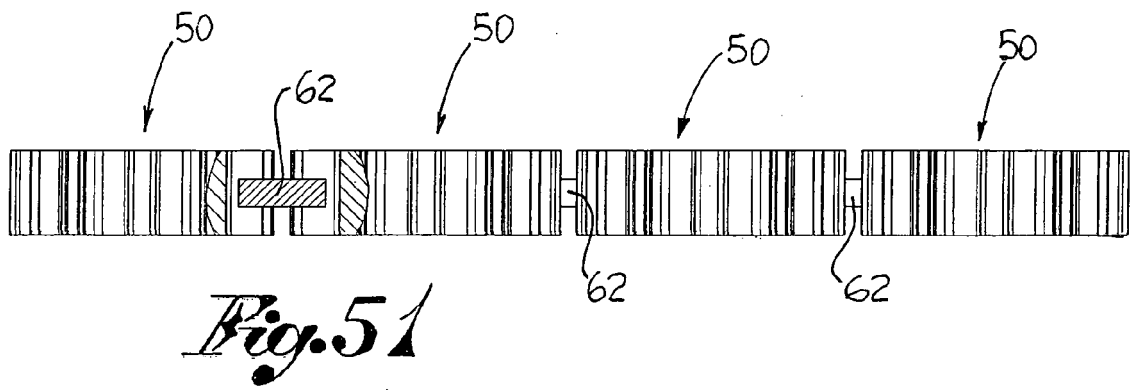
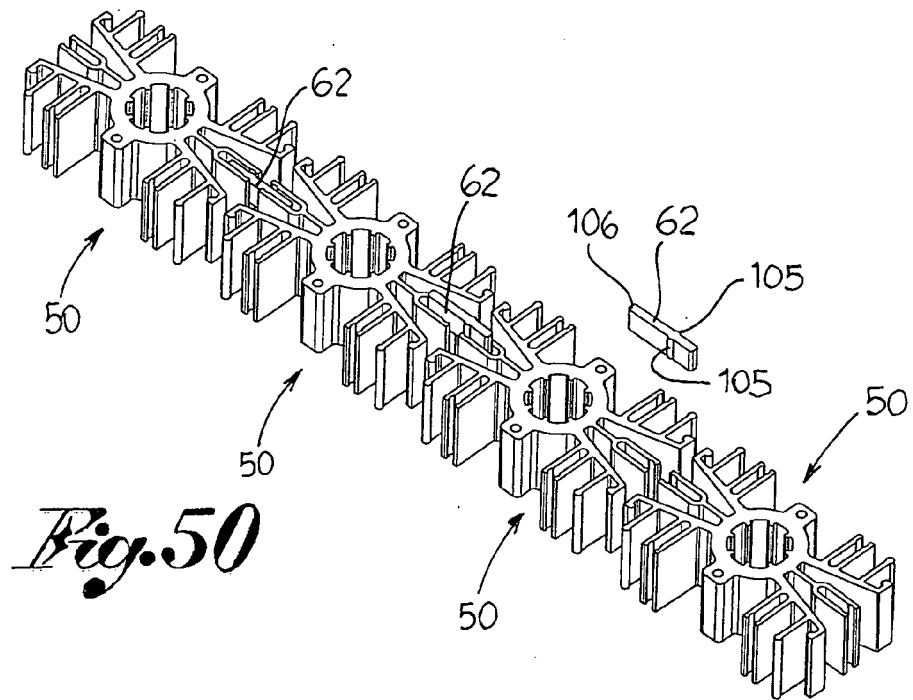
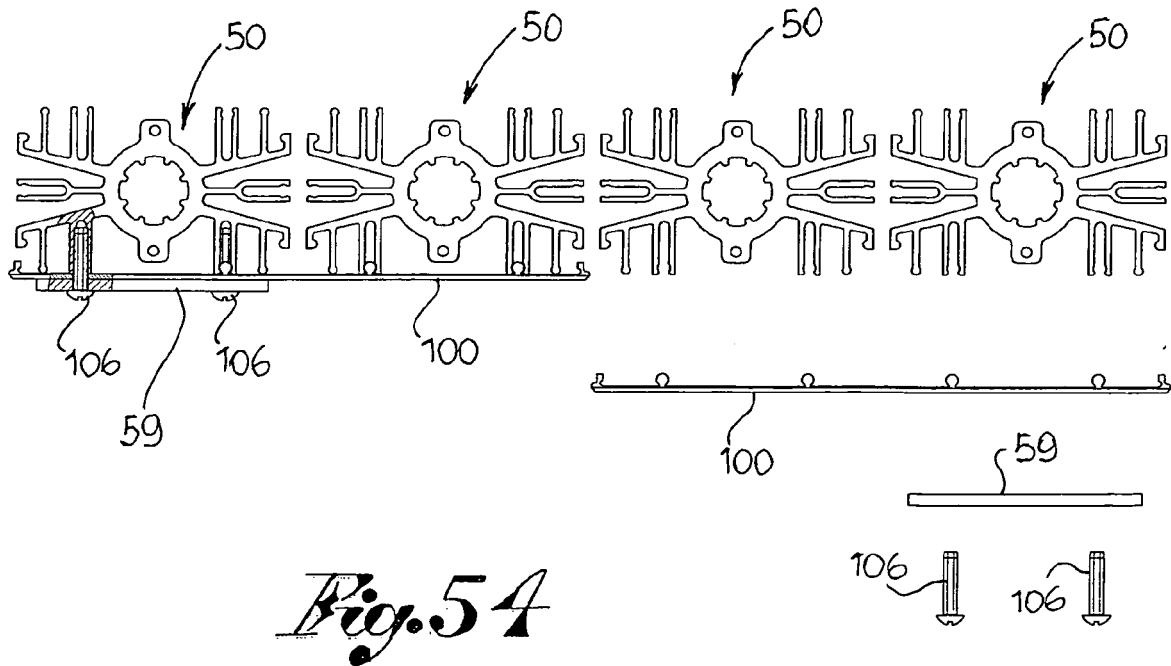
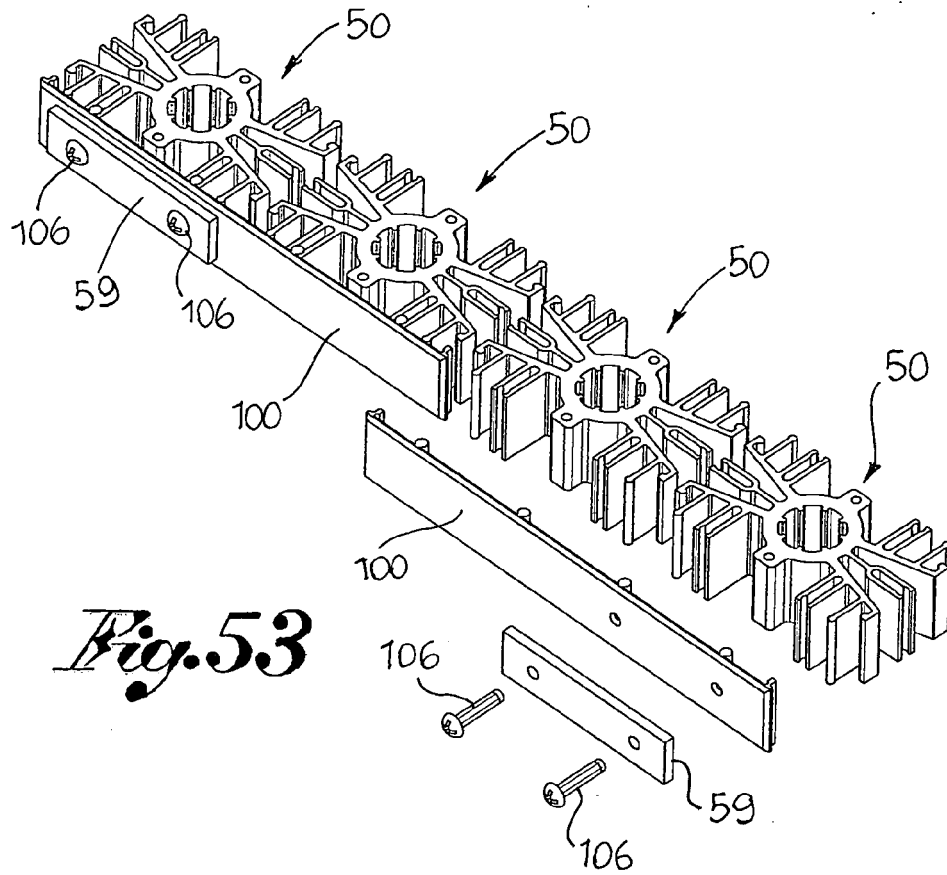


Fig. 45









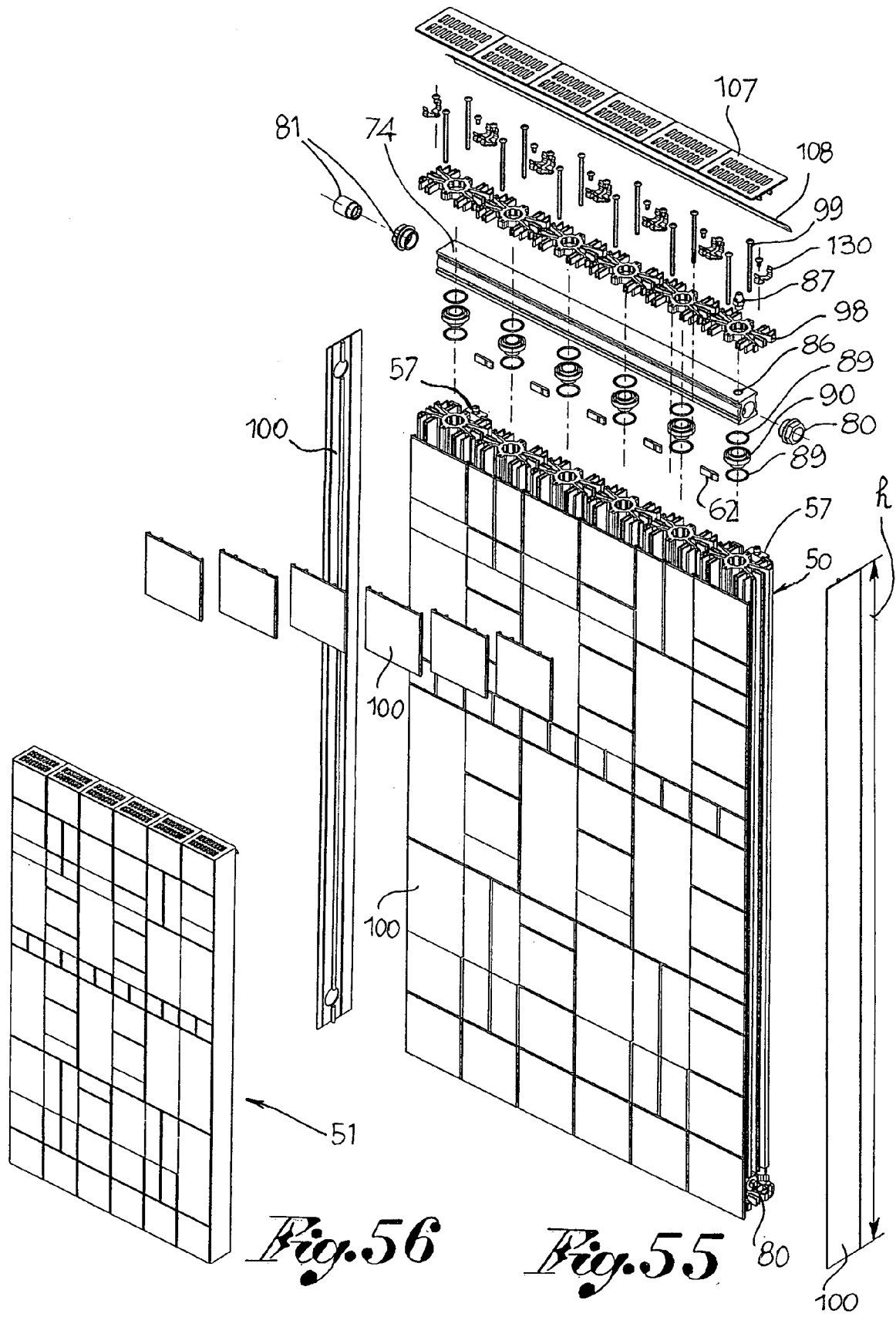
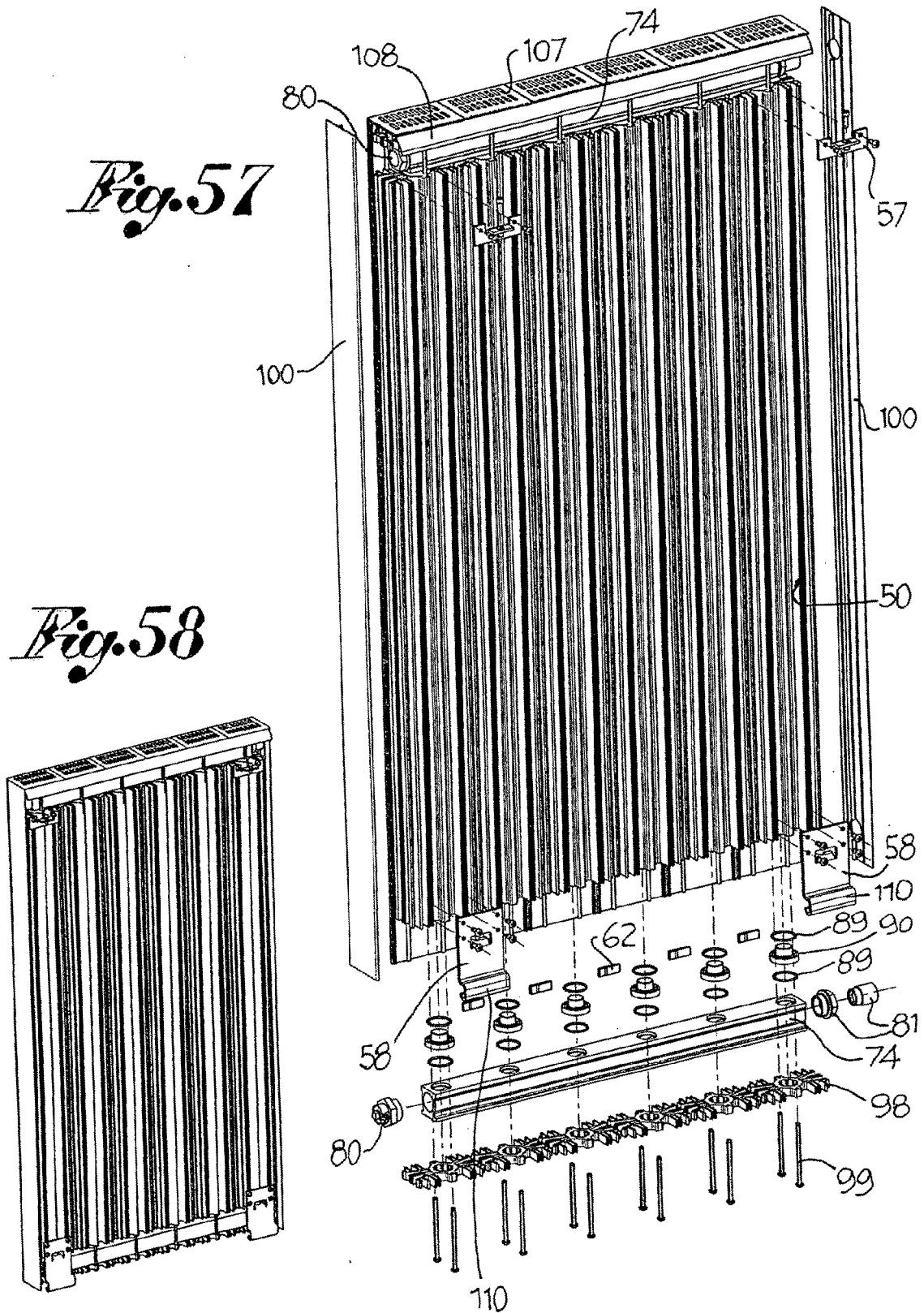


Fig. 56

Fig. 55

Fig.57

Fig.58



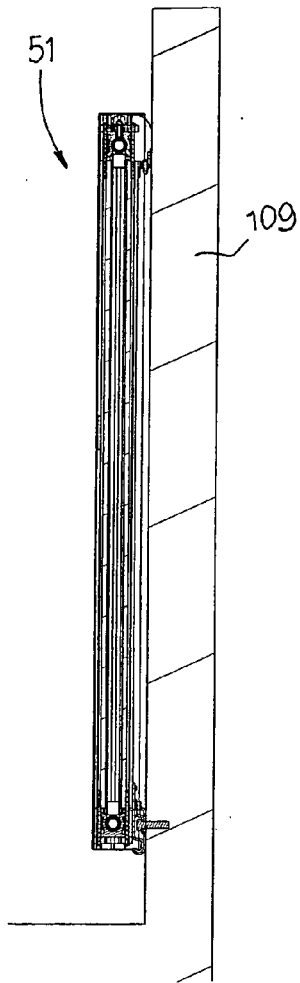


Fig. 59

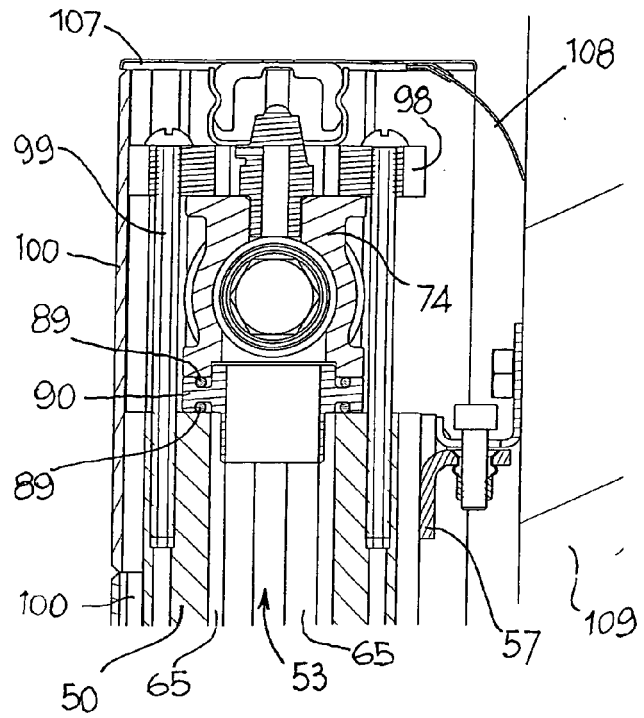


Fig. 60

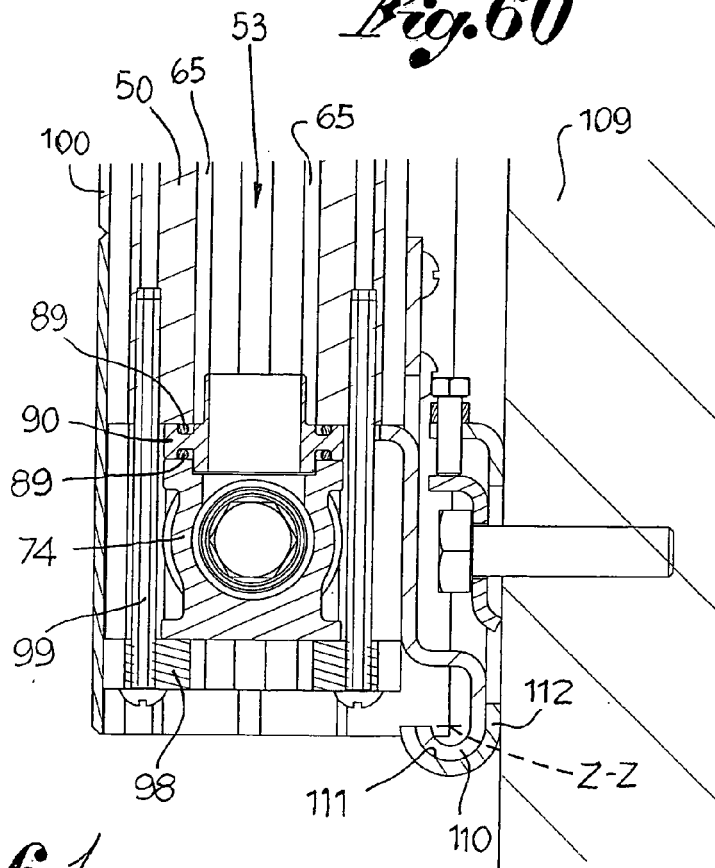


Fig. 61

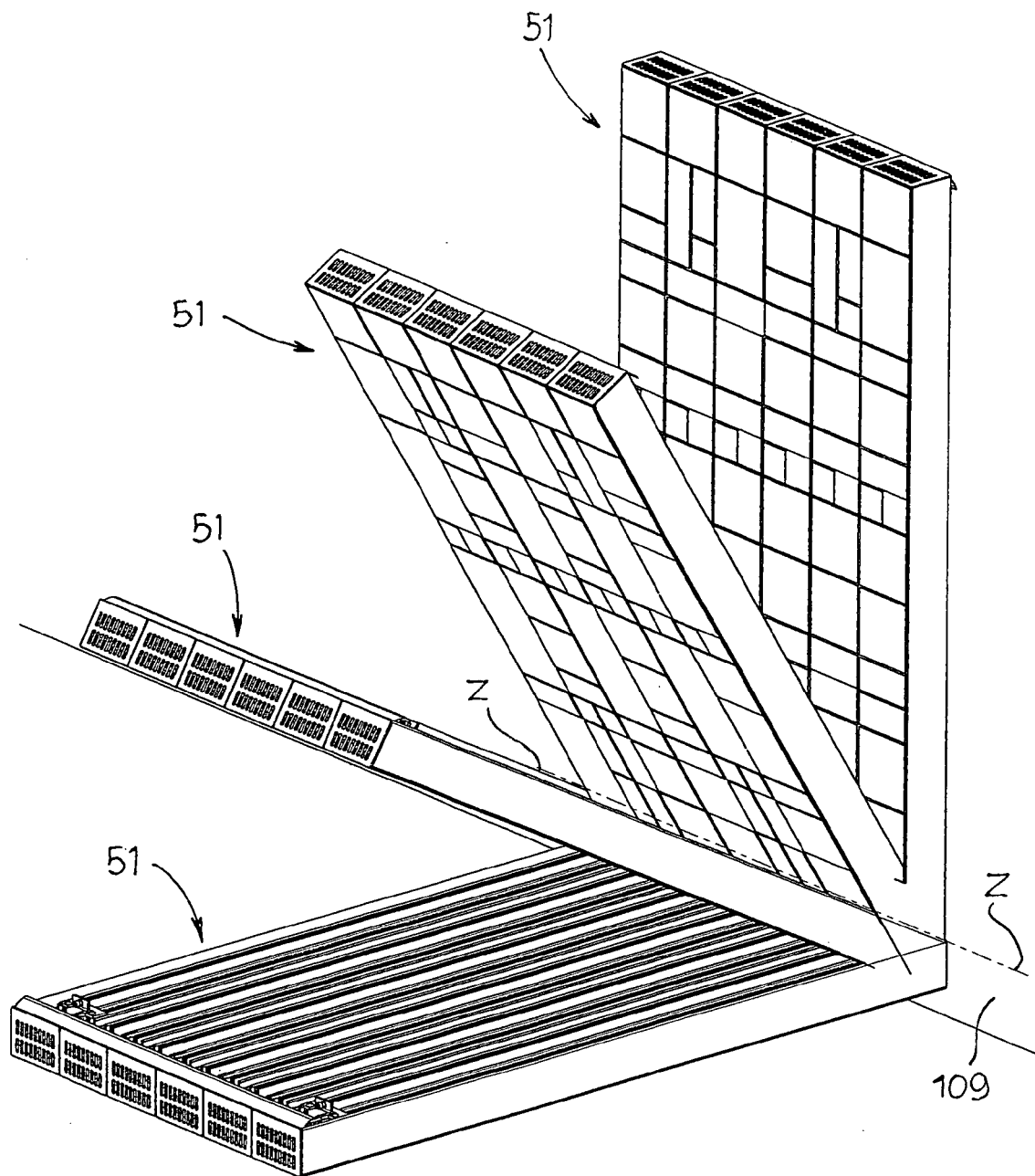


Fig. 62

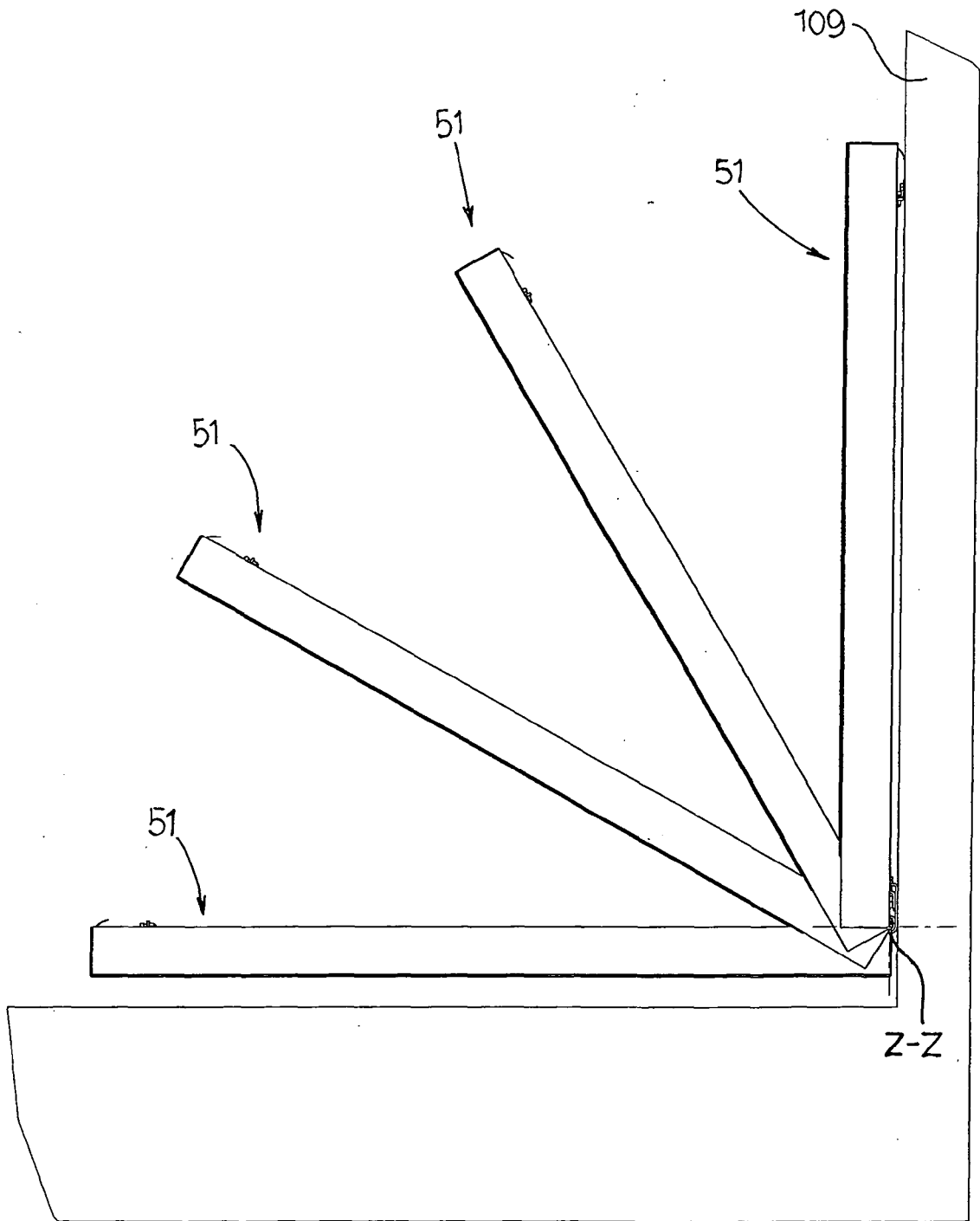


Fig. 63

