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(54) **A building element integrating subroof ventilation, eaves guard and gutter**

(57) This invention relates to a building element (52) for mounting in a pitched roof structure, which building element comprises a supporting element (78) integrally connected to a first airing element (54) and protruding from the first airing element (54) and having an outward facing surface (80) for receiving and supporting an underroof layer. The building element (52) further comprises a gutter member (56) for receiving drain water from the outer roof covering and/or the underroof layer and the gutter member (56) is integrally connected to the first airing element (54) protruding oppositely to the supporting element (78). The building element (52) constitutes an integral unit for providing support for the underroof layer at the lower edge of the pitched roof structure by the supporting element (78), and conducts drain water away from the pitched roof structure by the gutter member (56) reinforcing rigidity and strength of the building element (52).

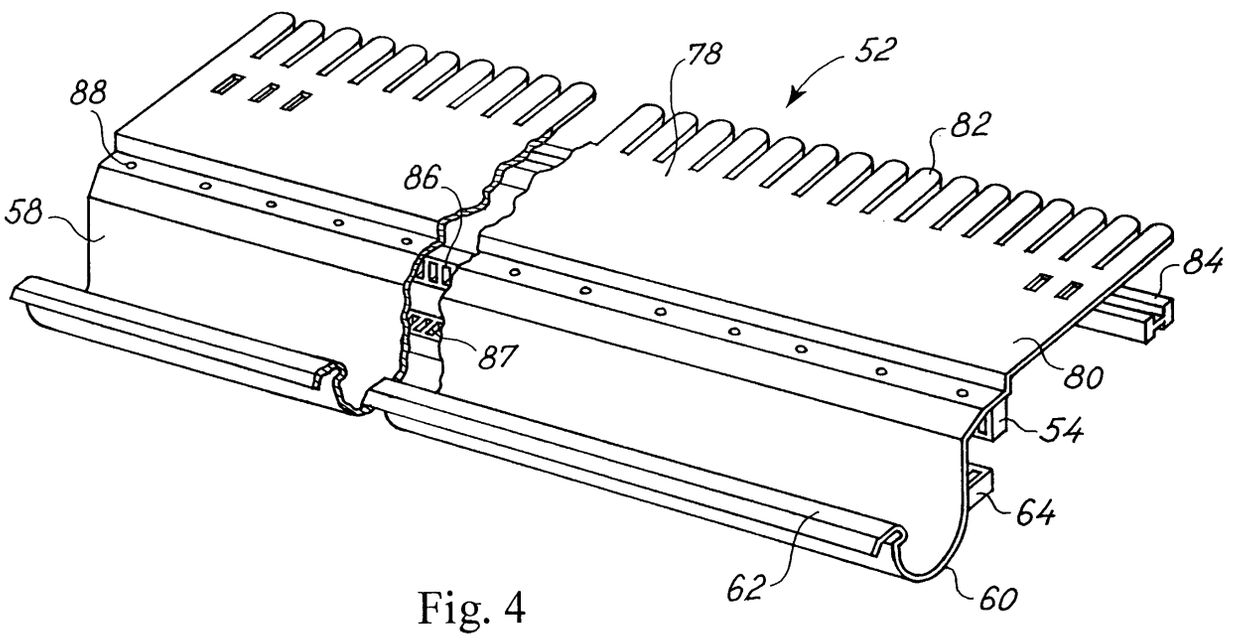

Fig. 4

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Description

[0001] The present invention relates to a building element for mounting in a pitched roof structure and providing ventilation of the pitched roof structure. The building element comprises an elongated airing element defining transverse air ducts for communicating air from the exterior to the pitched roof structure and a supporting element integrally connected to the first airing element for supporting and fixating an underroof layer. Additionally, the present invention relates to gutters for mounting below edge of the pitched roof structure for receiving drain water from the outer roof covering of the pitched roof structure.

[0002] Conventional ventilating eaves members such as described in international patent application no. WO 97/34062 establishes ventilation of a roof structure and prevents penetration of drift snow, insects and small animals as well as formation of water traps in an underroof film. The ventilating eaves member according to WO 97/34062 provides an integrally connected supporting plate for receiving and fixating an underroof film and airing element for providing ventilation between the underroof film and a building structure. The ventilating eaves member includes grooves for insertion of gutter brackets below the airing element, which gutter brackets supports a gutter.

[0003] Another conventional eaves structure is described in European patent application no. EP 1 001 108. This eaves structure includes two sections. A first part constitutes a roof gutter mounted onto the rafters extending from the outer wall of a building. A second part consists of a supporting body for supporting a layer of roofing felt and for providing a separation of the layer of roofing felt and the upper edge of the fascia of the roof. The first part is mounted on a fascia of a roof and the second part is arranged on top of the first part.

[0004] Another structural eaves assembly is described in United States Patent no. US 3,824,749 and is mounted on to an outer roof covering, hence this assembly generally is applied to a roof structure without an underroof membrane. The structural eaves assembly is provided with reinforcing baffles inserted in to the assembly and conforming to the cross sectional profile of the assembly so as to obtain a strengthened and a more rigid assembly. Further, the baffles function as supporting means for the assembly.

[0005] Additionally, the general state of the art provides for a fascia ventilator for roof having fascia board and external gutter described in British patent application no. GB 2 152 969. This fascia ventilator comprises a panel member defining a generally L-shaped configuration and having a plurality of ribs extend from its inner surface so as to allow for ventilation of roof via space between the ribs. The fascia ventilator has gutter fixing brackets secured on the panel member, which brackets receive a gutter.

[0006] Above referenced international patent application no. WO 97/34062, European patent application no. EP 1 001 108, United States patent no. US 3,824,749 and British patent applications nos. GB 2 325 476 and GB 2 152 969 are hereby incorporated by reference in the present patent specification. Each of roof members described in the above referenced patent and patent applications comprises a series of elements to be mounted on to the roof applying several working operations. This obviously reduces quality insurance and provides for cumbersome and long installing requirements as well as causes inefficient installation procedures. Carpentry of wooden pieces or elements, which is very often used, furthermore requires considerable craftsmanship and is also very labour intensive.

[0007] An object of the present invention is therefor to provide a building element having a integrated structure combining ventilation of a roof by means of air ducts and providing conduction of drain water away received from the roof by means of gutters.

[0008] A particular advantage of the present invention is the fact that the building element according to the present invention is simple and easy to install on a roof since the ventilating means and the gutters are quickly installed in one process.

[0009] A further advantage of the present invention is increased quality of the final roof product since by combining more features in one integrated building element improved reproducibility is achieved and thus less dependency on individually and specifically skilled labourers is needed.

[0010] Building traditions varies tremendously from area to area according to traditions or specific national or regional building requirements. In different areas rafters and laths may have various dimensions and the laths may be spaced at various distances. Hence a particular feature of the present invention is adaptability of the present invention to various roof structures having various dimensions.

[0011] Above object, advantages and feature together with numerous other objects, advantages and features which will be evident from below description of preferred embodiments of the present invention are according to a first aspect of the invention obtained by a building element for mounting between an underroof layer and outer surface of a rafter at a lower edge of a pitched roof structure including an outer roof covering and defining an inner space between said underroof layer and a building carrying said pitched roof structure, and said building element comprising:

a supporting element integrally connected to said first airing element and protruding from said first airing element in a first direction perpendicular to said longitudinal direction of said building element and in a direction toward said inner space, said supporting element having an outward facing surface for receiving and supporting said underroof layer, and a gutter member for receiving drain water from said

outer roof covering and/or said underroof layer, said gutter member being integrally connected to said first airing element and protruding from said first airing element in a second direction perpendicular to said longitudinal direction of said building element and oppositely to said first direction, and
said building element constituting an integral unit for providing support for said underroof layer at said lower edge of said pitched roof structure by said supporting element, and conduction of drain water away from said pitched roof structure by said gutter member reinforcing rigidity and strength of said building element.

[0012] In this context the terms upper and lower are to be construed relative to ground level of a building and the terms inner and outer are to be construed relative to the interior and exterior of a building. Further, the term inner space is in this context to be construed as an interior space defined between the underroof layer and a building carrying the pitched roof structure e.g. an inner space defined between the underroof layer and a ceiling being horizontal, pitched or a combination thereof (houses having cold or warm attics), an inner space defined between the underroof layer and a bearing wall (mansard roof), or an inner space defined between the underroof layer and soffit, bearing wall and ceiling (as in a pitched roof structure having an eaves section). These roof examples is not be construed limiting for the scope of the present invention.

[0013] Furthermore, the term integral unit in this context is to be construed in its broadest sense as a unitary unit or as a integral unit constituted by snapping, clipping, taping, welding, gluing parts together to form a integral unit.

[0014] Additionally, the term pitched roof structure is in this context to be construed as either a roof structure slanting towards all or some sides of a building or as a roof structure slanting from one side of a building to another side of the building e.g. gable roofs, hip roofs, lean-to roofs, mansard roofs, monitor roofs, imperial roofs or even combinations thereof.

[0015] According to the basic realisation of the first aspect of the present invention the building element may be cast, injection moulded or extruded so as to satisfy a wide variety of roof structures. Further, the building element may be constructed by casting, injection moulding or extruding a light and weather proof plastics material such as high density polyethylene, polypropylene, polyvinyl chloride, polyester, polycarbonate, ASA, ABS, SAN or copolymers and composites such as glass fibre reinforced polyester or epoxy and/or may be constructed by casting, shaping or folding a non-corrosive metal material such as stainless steel, copper, zinc or aluminium or any combinations thereof. By extruding, injection moulding or casting the building element in a plastic material or by folding the building element of a metal sheet a lightweight product is achieved, hence manoeuvrability of the building element during assembling the building element end to end on a roof structure is improved. Thus working accidents will accordingly be reduced. By casting, shaping or folding the building element in a non-corrosive metal material the strength and rigidity of the building element is increased thus withstanding even harsh environments e.g. heavier loads. Additionally, combinations of metal and plastic materials for the building element may be used, preferably with metal supports implemented by insert injection moulding or by snapping, taping, clipping, welding or gluing plastic and metal parts together to form the building element. Similarly, the building element may be constructed from snapping, taping, clipping, welding or gluing parts into an integral building element. Furthermore, any part of the building element may be covered with paint so as to increase the weather proofing features of the building element.

[0016] The underroof layer may be implemented as a plastic foil or film, or may be implemented using any underroof felt, which is known to the men skilled in the technical art. In this context the term underroof layer is to be construed as any type of underroofing material applied to the roof structure applying state of the art techniques such as an underroof foil, an underroof film, an underroof sheet, an underroof membrane or as any combinations thereof.

[0017] The building element according to the first aspect of the present invention further comprises a elongated first airing element defining longitudinal direction of the building element and having transverse air ducts for providing ventilation of the pitched roof structure. The elongated first airing element may be mountable on the pitched roof structure having the longitudinal direction of the building element parallel to the lower edge of pitched roof. The elongated first airing element provides ventilation of the pitched roof structure according to how the elongated first airing element is positioned on the building element. The elongated first airing element may be mounted on the upper side of the building element for providing ventilation of a space defined between the outer roof covering and the underroof layer or the elongated first airing element may be mounted on the lower side of the building element for providing ventilation of the inner space. By providing a building element having the first airing element positioned on either the upper or lower surface the building element may accomplish ventilation of the inner space as defined above or ventilation of the space defined between the underroof layer and the outer roof covering. The type of ventilation needed is determined in accordance with the roof structure, which typically differs from company to company as well as between countries. The advantage of the building element is therefore in this context the variety of roof structures may utilise the building element.

[0018] The first airing element according to the first aspect of the present invention may define holes for receiving fixation means such as screws, bolts or nails for

fixating the building element to a lower lath or batten of the pitched roof structure, a fascia board of the pitched roof structure or to a bearing wall of the building carrying the pitched roof structure. The first aspect of the invention may utilise the holes so as to engage the building element to the pitched roof structure or to engage the building element to a top surface of a bearing wall of the building construction. Generally the building element should be fixated at the fascia board. Alternatively the first airing element may be fixed to the roof structure by means of glue or by means of hooks or gripping means incorporated into the first airing element. Either form of these fixation means may be utilised thus providing the labourer to select a means in accordance with any type of roof structure.

[0019] The supporting element according to the first aspect of the present invention may be designed as a plate member extending from the first airing element in the first direction. Further, the supporting element may define a longitudinal edge having resilient fingers for adaptation to rafters in the pitched roof structure, which resilient fingers point in the first direction toward the inner space. Additionally or alternatively the supporting element may define stiffening ribs on underside thereof and/or define grooves on the underside in the longitudinal direction for receiving tap-like connection elements for connecting a plurality of building elements end to end. The length of the building element may vary and may be designed to fit any particular roof structure so as to design one long building element for the entire length of the building or so as to design several smaller building elements and interconnecting these smaller building elements. The advantage of having one long building element for the entire length of the building is obviously that the installation may be performed during one working operation. However, utilising smaller building elements provides an easy to handle and install working operation.

[0020] A generally known problem for roof structures is the fact that insects, birds or other small animals find their way into the roof structure and potentially causing deterioration of elements in the roof structure. Hence a further object of the first aspect of the present invention is to prevent these intrusions. Thus the building element may further comprise a bird barrier integrally connected to the building element and extending from the building element in a direction perpendicular to the longitudinal direction and substantially transverse to the first and second direction toward the outer roof covering. The bird barrier may have insect grating preventing insects and birds from entering the pitched roof structure and in particular preventing insects and birds from entering an inner space defined between said outer roof covering and said underroof layer.

[0021] The gutter member according to the first aspect of the present invention may define a gutter section for conducting drain water received from the lower edge of the pitched roof structure to drain pipes communicating with the gutter section, define a splashguard section connected to a first longitudinal edge of the gutter section for preventing the drain water from splashing out of the gutter section and define an eaves guard section connected to a second longitudinal edge of the gutter section and connected to the first airing element for providing alignment of the gutter section with the lower edge of the pitched roof structure and for preventing heavy shower, driving rain, drifting snow or hail blowing in under the pitch roof structure. It is important to avoid that moisture enters into the inner space of the pitched roof structure since the moisture and later humidity may cause the thermal insulation material to deteriorate.

[0022] Further, the building element may comprise a second airing element integrally connected to the building element and defining transverse air ducts communicating exterior air to the first airing element and protruding from the eaves guard section of the gutter member in the first direction and the second airing element providing support for the gutter member. The second airing element may have its distal end resting against the fascia board and/or resting against a bearing wall of the building construction carrying the pitched roof structure, thus providing a stable support for the gutter member. The second airing element may be constituted by an eaves panel having air ducts and thus may provide a complementary finish to the roof structure. However, the main purpose of the second airing element is to provide extra support for the gutter member so as to establish a rigid arrangement capable of withstanding heavy loads.

[0023] The above-described sections defined by the gutter member may be implemented having various geometric shapes. Thus the splashing guard section of the gutter member may define a cross sectional profile being shaped as a L, a P, an O, a C, being shaped like a hook or having a semi-circular, circular, semi-elliptic, elliptic, triangular or rectangular cross sectional profile or any combinations thereof. The various profiles of the splashing guard section ensure at least two objectives. One objective is to prevent splashing of drain water out of the gutter member thus providing a splash free zone directly below the gutter member. A second objective is to further increase rigidity of the gutter member by shaping the upper part of the gutter member namely the splashing guard section so that upper part folds down either into the gutter section or on to or along the outside of the gutter section. A further objective is to improve the artistic design of the gutter member.

[0024] Further geometric shapes of cross sectional profiles of sections of the gutter member may include the gutter section of the gutter member defining an inner space or inner spaces each having a cross sectional profile being semi-circular, circular, semi-elliptic, elliptic, triangular, rectangular shaped or any combinations thereof. The first and the second airing element respectively may define an inner space or inner spaces having cross sectional profiles shaped semi-circularly, circular-

ly, semi-elliptically, elliptically, triangularly, rectangularly or shaped in any combinations thereof. These various construction details accomplish various tasks. Generally, the construction details are determined in accordance with production costs and in accordance with desired functionalities to be included in the building element.

[0025] The building element according to the first aspect of the present invention may additionally comprise an elevated support for providing support for the outer roof covering being integrally connected to the building element, protruding upwards from the supporting element, and defining an inner space or inner spaces having cross sectional profiles shaped semi-circularly, circularly, semi-elliptically, elliptically, triangularly, rectangularly or shaped in any combinations thereof. The outer roof covering may be tiles, slates, metal plates e.g. steel or aluminium plates, ceramic plates, wooden shingles or a thatched roof. The tiles may due to rough surfaces induce holes or scratches in the underroof layer, thus weakening the sealing of the roof structure. Hence, elevating the tiles away from the underroof will ensure that the underroof is protected and in some cases provide air ventilation between the underroof layer and the outer roof covering. The air ventilation may be achieved by introducing transverse air ducts in the elevated support or by utilising the outer roof covering's profile, which in some cases provides for a gap between the elevated support and the outer roof covering.

[0026] Further, the building element according to the first aspect of the present invention may further comprise reinforcing brackets for providing a rigid gutter member being integrally connected to the building element at longitudinally spaced intervals or integrally connected to the building element at longitudinal ends of the building element for providing reinforcement of connections between a plurality of building elements connected end to end. Depending on the longitudinal length of the building element any number of reinforcement brackets may be included in the casting of the building element so as to provide a more rigid construction. The brackets may be constructed from plastics materials such as high density polyethylene, polypropylene, polyvinyl chloride, polyester, polycarbonate, ASA, ABS, SAN, copolymers and composites such as glass fibre reinforced polyester or epoxy or may constructed from non-corrosive metal materials such as stainless steel, copper, zinc or aluminium or any combinations thereof. A well-known technique is insert injection moulding, where the brackets are directly placed in the moulding cavity.

[0027] The building element according any of the above described embodiments of the present invention may further comprise a first integrated link connection located between the first airing element and the supporting element and the first integrated link connection ensuring rotation of the supporting element relative to the first airing element. Additionally, the building element may further comprise a second integrated link connection located between the second airing element and the eaves guard member of the gutter member and the second integrated link connection ensuring rotation of the gutter member relative to the second airing element. These integrated link connections (known as integrated hinges in the technical field of injection moulding) enables the building element to be applied in a wide variety of roof structures and further reduces the storage capacity needed since the supporting element and the gutter member may fold so as to provide a smaller unit to be carried and stored.

[0028] The building element according to any of the above described embodiments of the present invention may be implemented in corrugated metallic material having corrugations in a plane perpendicular to the longitudinal direction of the building element so as to provide rigidity of the building element. The corrugations significantly increase the rigidity and strength of the building element.

[0029] The building element according to the first aspect of the present invention may be mounted on roof structures having no fascia i.e. directly on to the bearing wall of the building or on roof structures having no eaves. Further the building element is suitable for mounting in a pitched roof structure having an attic utilised as top floor of a house, or in a building having a ceiling parallel to the pitched roof or even in a building not having a underroof layer.

Brief description of the drawings

[0030]

Figure 1, shows a cross sectional view of a roof structure according to the prior art technique.

Figure 2, shows a cross sectional view of a building element integrating subroof ventilation, eaves guard and gutter according to a first embodiment of the present invention.

Figure 3, shows a cross sectional view of a gutter member of a building element integrating subroof ventilation, eaves guard and gutter according to a second embodiment of the present invention.

Figure 4, shows a three dimensional view including a cut away section of a building element integrating subroof ventilation, eaves guard and gutter according to the first embodiment of the present invention.

Figure 5a to 5d, show cross sectional views of building elements integrating subroof ventilation, eaves guard and gutter according to third, fourth, fifth, and sixth embodiment of the present invention.

Detailed description of the present invention

[0031] The invention will below be described in further detail with reference to the above listed figures.

[0032] Figure 1 shows a cross sectional view of a building designated in its entirety by numeral 10, which building 10 comprises building elements in particular gutter, ventilating eaves member, outer roofing cover and underroof membrane according to prior art techniques such as described in international patent application WO 97/34062. The building 10 comprises a lower section 12 having a bearing outer wall 14, an inner sheathing 16 and a vertical layer of insulating material 18 between the bearing outer wall 14 and the inner sheathing 16.

[0033] Furthermore the lower section 12 has a ceiling 20 separating the lower section 12 from a pitched roof structure 22. The pitched roof structure 22 shown in figure 1 consists of a series of rafters 24 defining an inner space or an attic 26 between the ceiling 20 and the series of rafters 24. In houses where the attic is not utilised for living quarters a horizontal layer of insulating material 28 is located between the attic 26 and the ceiling 20 to prevent or to limit thermal exchange between the inside of the building 10 and the attic 26, sometimes referred to as cold attic. In houses where the attic is utilised (not shown in figure 1) an insulation material will be inserted between an underroof membrane 30 and a ceiling positioned on the lower side of the series of rafters 24 of the attic 26, sometimes referred to as warm attic. Alternatively some houses may have utilised the attic 26 by removing the ceiling 20. The roof configurations vary not only from country to country but may indeed vary from roofing company to roofing company, generally, in accordance with traditions in countries or roofing companies.

[0034] The series of rafters 24 support the underroof membrane 30, which ensures that water does not enter from the outside in to the attic 26 while in some cases ensuring that moisture is transmitted to the outside from the attic 26. The underroof membrane 30 acts during construction as a primary water barrier and acts when the roof is fully assembled as a secondary water barrier. The underroof membrane 30 is fixated to the series of rafters 24 by a series of spacing lists 32 nailed to the pitched surface of the series of rafters 24, that is longitudinally on the rafters. Alternatively, the underroof membrane 30 is fixated to the series of rafters 24 by nailing a plurality of battens or laths 34a-c on top of the outward-facing surface of the series of rafters 24.

[0035] In figure 1 the laths 34a-c are fastened to the spacing lists 32 in a direction perpendicular to the longitudinal direction of the series of rafters 24 and hence in a direction perpendicular to the series of spacing lists 32, which laths 34a-c support an outer roof covering 36. The outer roof covering 36 may be constituted by tiles, slates, metal plates e.g. steel or aluminium plates, ceramic plates, wooden shingles or a thatched roof. In figure 1 the outer roof covering 36 is constituted by tiles 38a-c.

[0036] A lower lath 40 is positioned at the eaves of the series of rafters 24. The lower lath 40 supports a wing shaped arrangement 42 for supporting a ventilating eaves member 44. The ventilating eaves member 44 provides support for the outer roof covering 36 and for the underroof membrane 30 while enabling ventilation of the attic 26.

[0037] A fascia board 46 is mounted onto the series of rafters 24 for providing a nice smooth finish to the pitch roof structure 22 and for providing a surface for mounting of brackets 48 for supporting and fixating a gutter 50.

[0038] Figure 2, shows a cross sectional view of a building element 52 integrating subroof ventilation, eaves guard and gutter according to a first and presently preferred embodiment of the present invention. The building element 52 comprises a first airing element 54 positioned on lower side of the building element 52 and allowing exterior air to an inner space of a pitched roof structure. The inner space is defined between the underroof layer and a ceiling of a pitched roof structure including a space defined between the rafters, in figure 1 the inner space is shown as reference numeral 26.

[0039] In an alternative embodiment of the present invention the first airing element 54 is positioned on upper side of the building element 52 allowing exterior air to a space defined between outer roof covering and underroof layer. This alternative embodiment is especially useful for non-ventilated roof structures utilising an underroof layer having a water and water vapour resistant, water impermeable and water vapour permeable barrier layer.

[0040] The building element 52 is fixated to a fascia board 55 by receiving fixation means through the first airing element 54. The fascia board 55 supporting the building element 52 is mounted on vertical sections of rafters (shown in figure 1 with reference to numeral 24) in a pitched roof structure. Alternatively, the building element 52 is mounted directly on to a bearing wall or on to a lower lath. The building element 52 further supports on its top surface an outer roof (shown in figure 1 with reference to numeral 36).

[0041] A gutter member 56 is integrally connected to the first airing element 54 and consists of an eaves guard section 58 adjacent to the fascia board 55, which eaves guard section 58 connects the first airing element 54 with a gutter section 60 of the gutter member 56. The gutter section 60 generally constituting a "U" type shape has one distal end integrally connected to the eaves guard section 58 closest to the fascia board 55 and the other distal end integrally connected to a splashing guard section 62 of the gutter member 56. The splashing guard section 62 prevents rain water received in the gutter section 60 to splash out of the gutter member 56 and furthermore the splashing guard section 62 may be shaped so as to increase the strength and rigidity of the

gutter member 56. As shown in figure 2 the splashing guard section 62 is folded once which significantly increases the mechanical stability of the gutter member 56 and thus increases the stability and strength of the overall building element 52.

[0042] The eaves guard section 58 of the gutter member 56 may be in any arbitrary length so as to provide for any custom designs of the building element 52. Different roof structures may have different lengths of fascia board 55 and thus different lengths of the eaves guard section 58 are desirable.

[0043] The building element 52 shown in figure 2 further comprises a second airing element 64 integrally connected to the eaves guard section 58 of the gutter member 56 and provides vertical support for the gutter member 56 and improves stability of the gutter member 56. The second airing element 64 provides a spacing between the eaves guard section 58 and the fascia board 55 and communicates airflow in the spacing between the fascia board 55 and the eaves guard section 58 from beneath the gutter member 56 to the first airing element 54. The airflow ventilates and removes humidity within a roof structure. A constant high humidity will severely increase deterioration of the wooden parts of the roof structure such as rafters, battens or laths or increase deterioration of insulation material, since a high humidity provides an environment for fungus attack.

[0044] The building element 52 according to the first embodiment of the present invention may be constructed in any light and weather proof plastics material such as but not limited to high density polyethylene, polypropylene, polyvinyl chloride, polyester, polycarbonate, ASA, ABS, or SAN or copolymers and composites such as glass fibre reinforced polyester or epoxy. Alternatively the building element 52 may be constructed in a non-corrosive metal material such as stainless steel, copper, zinc or aluminium or any combinations thereof.

[0045] The building element 52 may further be implemented by applying various production techniques. For example the building element 52 may be produced by applying casting, shaping or folding of metal materials or may be produced by applying casting, injection moulding, extruding or forming plastic materials into building elements according to the present invention. Alternatively, the building element 52 may be produced by snapping, taping, clipping, welding or gluing parts to form the building element 52.

[0046] Figure 3, shows a cross sectional view of an alternative shape of a gutter member 66. The gutter member 66 being an integral part of a building element according to a second embodiment comprises an eaves guard section 68, a gutter section 70 and a splashing guard section 72. The gutter member 66 is constituted by a one sheet of material folded at the splashing guard section 72 around the outside and back down constituting an outside layer 74 of the gutter section 70. As the outside layer 74 reaches the eaves guard section 68 the sheet of material is folded so as to form a second airing element 76. The second airing element 76 having holes communicates airflow to a first airing element, not shown in figure 3. The folded sheet of material thus constitutes the second airing element 76 and the folding increases the strength of the support and gives an overall rigidity of the building element.

[0047] Figure 4, shows a three dimensional view of a building element 52 integrating subroof ventilation, eaves guard and gutter according to the first and presently preferred embodiment of the present invention. A supporting element 78 extends from of the first airing element 54 in a direction towards the interior of the pitch roof structure and perpendicularly relative to longitudinal direction of the first airing element 54.

[0048] The supporting element 78 being an integral part of the building element 52 comprises means for supporting and fixating an underroof layer so as to ensure that the underroof layer is pulled tight thus avoiding heavy shower, driving rain, drifting snow, or hail blowing in under the pitch roof structure and avoiding debris from gathering under the pitch roof structure. The fixating of the underroof layer may be performed by clamping means, tape, glue, welding or clips-like holding means for keeping the underroof layer in a locked position at a upper surface 80 defined supporting element 78. Since the upper surface 80 shaped as a sheet member with considerable width, a safe securing of the bottom part of the underroof layer is accomplished reducing any tendency to the formation of water traps or accumulation of water. The supporting element 78 may be provided with a plurality of stiffening flanges on the lower surface. The plurality stiffening flanges ensures a rigid supporting element 78 and improves the overall strength of the building element 52.

[0049] At the edge of the supporting element 78 pointing toward the interior of the pitched roof structure the supporting element 78 has protruding resilient fingers 82, which ensures a simple and easy adaptation of the building element 52 to any types of rafters used in the pitched roof structure. By bending the fingers either upward or downward the fingers 82 may be broken away opposite the rafters.

[0050] The supporting element 78 receives on its lower surface connection elements 84 for connecting building element 52 from end to end. Thus the building element 52 may be adapted to any length of a pitched roof structure be connecting any series of building elements 52.

[0051] Each connection between a series of building elements may be implemented in accordance with the general state of the art in the technical field such as profiling of left and right side of the building elements so as to fit exactly into each other. Alternatively, each connection may include packing material so as to ensure that the building elements provide a seal from the top surface to the bottom surface. Furthermore, the connections between building elements further contribute to the overall mechanical strength of the gutter members and support-

ing elements of each of the building elements thus providing a stronger construction of the series of building elements connected end to end.

[0052] The first airing element 54 comprises a first series of air ducts 86 communicating airflow transversely to the longitudinal direction of the first airing element 54. The first airing element 54 further comprises a plurality of bores 88 for receiving nails, screws, bolts or rivets fixating the building element 52 to the pitched roof structure to a lower lath or batten, fascia board or directly on to a bearing wall. Any type of fastening means may be applied and the bores may be produced in accordance with customer wishes.

[0053] The second airing element 64 comprises a second series of air ducts 87 communicating similarly to the first series of air ducts 86 airflow transversely to the longitudinal direction of the second airing element 64. The second series of air ducts 87 and the first series air ducts 86 constitute cylindrical bores which may have any cross sectional shape desirable such a circular, semi-circular, elliptic, semi elliptic, triangular or rectangular. The first and second series of air ducts 86 and 87 may define a total cross sectional area per unit of longitudinal length of the building element in a range between 100 cm^2/m to 500 cm^2/m typically in the range between 200 cm^2/m to 250 cm^2/m depending on calculated technical standards for ventilation or on national or business traditions.

[0054] The building element 52 defines a longitudinal length parallel to the first airing element 54, which length may be in the interval between 0.2 to 20m such as 0.4 to 10m, 0.6 to 6m or preferably in the interval 0.8 to 2m. Alternatively the longitudinal length of the building element 52 may be in the intervals 0.2 to 0.6m, 0.7 to 1.2m, 1.3 to 4m, or in the interval 4.1 to 20m.

[0055] Figures 5a to 5d, show cross sectional views of building elements according to third, fourth, fifth and sixth embodiment of the present invention.

[0056] Figure 5a, shows a cross sectional view of a building element according to a third embodiment of the present invention, which building element is designated in its entirety by numeral 90. The building element 90 comprises a gutter section 92 having an upper part 94 and a lower part separated by longitudinal ribs 98. This construction provides an especially rigid building element 90 without the weight of the building element 90 increases significantly. The building element 90 further comprises a splashing guard section 100 being shaped as an "O". This ensures that the outward facing part 102 of the gutter section 92 becomes rigid and strong.

[0057] Figure 5b, shows a cross sectional view of a building element according to a fourth embodiment of the present invention, which building element is designated in its entirety by numeral 104. The building element 104 comprises a bird and insect screen 106 for keeping birds and insects out of the interior of the pitched roof structure. Nesting of birds in the attic may cause severe destruction of vital components of the roof. Similarly the introduction of insects into the attic may cause vital components of the roof infected or consumed. The building element 106 further comprises a first airing element 108 and a second airing element 110, which first and second airing elements 108, 110 are constructed from longitudinal hollow cylinders while having air ducts in the transverse direction. The hollow first and second airing elements 108,110 reduce the overall weight of the building element 104, which simplifies the mounting of the building element 104 since the craftsman may carry and handle more than one of the building element 104.

[0058] Figure 5c, shows a cross sectional view of a building element according to a fourth embodiment of the present invention, which building element is designated in its entirety by numeral 112. The building element 112 comprises a first hollow airing element 114, a second hollow airing element 116 and a third hollow airing element 118. The third hollow airing element 118 engages with the first hollow airing element 114 and with an upper part of an eaves guard section 120. This increases significantly the rigidity of the entire building element 112 without significantly increasing the weight of the building element 112.

[0059] Figure 5d, shows a cross sectional view of a building element according to a fourth embodiment of the present invention, which building element is designated in its entirety by numeral 122. The building element 122 comprises a first hollow airing element 124, a second hollow airing element 126 and a third hollow airing element 128. The third hollow airing element 128 engages with the first hollow airing element 124 and constitutes the upper part of an eaves guard section 130. Further the second hollow airing element 126 engages with the third airing element 128 so as to increase the rigidity of the upper part of the eaves guard section 130. Additionally, the building element 122 further comprises an elevated support 132 providing support for the outer roof covering. The elevated support 132 is integrally connected to the building element 122 and protrudes upward from a supporting element 134 described with reference to figure 3 as numeral 78. The elevated support 132 is shown in figure 5d as being hollow and may define any cross sectional shape as well as being solid and define any cross sectional shape. Since the outer roof covering may be tiles, slates, metal plates e.g. steel or aluminium plates, ceramic plates, wooden shingles or a thatched roof, which all may due to rough surfaces induce holes or scratches in an underroof layer and thus weakening the sealing of the roof structure. Hence, elevating the tiles away from the underroof will ensure that the underroof is protected.

[0060] In an alternative embodiment of the present invention the elevated support 132 comprises transverse air ducts for supplying exterior air to a space defined between the outer roof covering and the underroof layer. In this alternative embodiment the transverse air ducts in the elevated support 132 constitute the first airing el-

ement thus in this alternative embodiment no transverse air ducts are provided for on the lower side of the building element in the elements designated by numeral 124 and 126. As described with reference to figure 2, this alternative embodiment is particularly utilised for non-ventilated roof structures having an underroof layer with a water impermeable and water vapour permeable barrier layer.

[0061] Figures 5a to 5d show a variety of different implementation types of splashing guard sections. Figure 5a shows a splashing guard section 100 shaped as an "O", figure 5b shows a splashing guard section 105 shaped as a mirrored "C", figure 5c shows a splashing guard section 113 shaped as a hook, and figure 5d shows a splashing guard section 123 shaped as a semi-fold. The various shapes of the splashing guard sections 100, 105, 113 and 123 generally improve the overall rigidity of the gutter member of the building elements 90, 104, 112 and 122 so as to increase the strength of the building element 90. The shapes reduce the elasticity perpendicular to the longitudinal direction of the building element 90, 104, 112 and 122 thus the gutter members may endure heavier loads such as caused by snow or debris. Obviously any of the splashing guard sections 100, 105, 113 and 123 may be combined with any building element according to the present invention. The combinations shown in figures 5a to 5c should only be construed as examples and should not be construed as limitations to the scope of the present invention.

[0062] Figures 5a to 5d show a variety of different implementations of building elements 90, 104, 112 and 122, which in alternative embodiments may include one or more integrated link connections shown in figure 5d as numerals 136, 138. The first integrated link connection 136 enables the supporting element 134 to be rotated so as to match the angle of any particular angle of the outer surface of a rafter. Additionally, the second integrated link connection 138 may be implemented in any of the building elements 90, 104, 112 and 122 thus improving the adaptability of the building elements 90, 104, 112 and 122 to any particular roof structure. Furthermore, the integrated link connections 136 and 138 provide for easy storage and improved manoeuvrability during mounting of the building element 122.

[0063] The building elements according to first through sixth embodiment of the present invention may further implemented in corrugated metal so as to increase the mechanical strength. The corrugations in the metal are in a direction perpendicular to the longitudinal direction of the building elements thus significantly increasing the rigidity of the building element.

[0064] Additionally, the building element according to first through sixth embodiment of the present invention may further comprise metal braces to be included during casting of plastic embodiments of the building elements or included during a subsequent working process. The metal braces further strengthening the building elements.

Claims

1. A building element for mounting between an underroof layer and outer surface of a rafter at a lower edge of a pitched roof structure including an outer roof covering and defining an inner space between said underroof layer and a building carrying said pitched roof structure, and said building element comprising:

   a supporting element integrally connected to said first airing element and protruding from said first airing element in a first direction perpendicular to said longitudinal direction of said building element and in a direction toward said inner space, said supporting element having an outward facing surface for receiving and supporting said underroof layer, and
   a gutter member for receiving drain water from said outer roof covering and/or said underroof layer, said gutter member being integrally connected to said first airing element and protruding from said first airing element in a second direction perpendicular to said longitudinal direction of said building element and oppositely to said first direction, and
   said building element constituting an integral unit for providing support for said underroof layer at said lower edge of said pitched roof structure by said supporting element, and conduction of drain water away from said pitched roof structure by said gutter member reinforcing rigidity and strength of said building element.

2. A building element according to claim 1, **characterised in that** said building element being constructed by casting, injection moulding or extruding a light and weather proof plastics materials such as high density polyethylene, polypropylene, polyvinyl chloride, polyester, polycarbonate, ASA, ABS, SAN or copolymers and composites such as glass fibre reinforced polyester or epoxy and/or being constructed by casting, shaping or forming a non-corrosive metal materials such as stainless steel, copper, zinc or aluminium or any combinations thereof.

3. A building element according to claims 1 or 2, **characterised in that** said building element further comprising a elongated first airing element defining longitudinal direction of said building element and having transverse air ducts for providing ventilation of said pitched roof structure, said elongated first airing element mountable on said pitched roof structure having said longitudinal direction of said building element parallel to said lower edge of pitched roof.

4. A building element according to claims 1 to 3, **char-**

acterised in that said elongated first airing element being mounted on upper side of said building element for providing ventilation of a space defined between said outer roof covering and said underroof layer.

5. A building element according to claims 1 to 3, **characterised in that** said elongated first airing element being mounted on lower side of said building element for providing ventilation of said inner space.

6. A building element according to claims 1 to 5, **characterised in that** said first airing element defining holes for receiving fixation means such as screws, bolts or nails for fixating said building element to a lower lath or batten of said pitched roof structure, a fascia board of said pitched roof structure or to a bearing wall of said building carrying said pitched roof structure.

7. A building element according to any of claims 1 to 6, **characterised in that** said supporting element being designed as a plate member extending from said first airing element in said first direction and said supporting element defining a longitudinal edge having resilient fingers for adaptation to rafters in said pitched roof structure, said resilient finger pointing in said first direction toward said inner space, and/or said supporting element defining stiffening ribs on underside thereof, and/or said supporting element defining grooves on said underside in said longitudinal direction for receiving tap-like connection elements for connecting a plurality of building elements end to end.

8. A building element according to any of claim 1 to 7, **characterised in that** said building element further comprising a bird barrier integrally connected to said building element and extending from said building element in a direction perpendicular to said longitudinal direction and substantially transverse to said first and second direction toward said outer roof covering, said bird barrier having insect grating preventing insects and birds from entering said pitched roof structure and in particular preventing insects and birds from entering said inner space and a space defined between said outer roof covering and said underroof layer.

9. A building element according to any of claims 1 to 8, **characterised in that** said gutter member defining a gutter section for conducting drain water received from said lower edge of said pitched roof structure to drain pipes communicating with said gutter section, defining a splashguard section connected to a first longitudinal edge of said gutter section for preventing said drain water from splashing out of said gutter section and defining an eaves guard section connected to a second longitudinal edge of said gutter section and connected to said first airing element for providing alignment of said gutter section with said lower edge of said pitched roof structure and for preventing heavy shower, driving rain, drifting snow or hail blowing in under the pitch roof structure, and said building element further comprising a second airing element integrally connected to said building element and defining transverse air ducts communicating exterior air to said first airing element and protruding from said eaves guard section of said gutter member in said first direction and said second airing element providing support for said gutter member.

10. A building element according to claim 9, **characterised in that** said splashing guard section of said gutter member defining a cross sectional profile being shaped as a L, a P, an O, a C, being shaped like a hook or having a semicircular, circular, semi-elliptic, elliptic, triangular or rectangular cross sectional profile or any combinations thereof.

11. A building element according to claims 9 or 10, **characterised in that** said gutter section of said gutter member defining an inner section or inner sections each having a cross sectional profile being semi-circular, circular, semi-elliptic, elliptic, triangular, rectangular shaped or any combinations thereof.

12. A building element according to any of claims 9 to 11, **characterised in that** said first and said second airing element respectively defining an inner part or inner parts having cross sectional profiles shaped semi-circularly, circularly, semi-elliptically, elliptically, triangularly, rectangularly or shaped in any combinations thereof.

13. A building element according to any of claims 1 to 12, **characterised in that** said building element further comprising an elevated support for providing support for said outer roof covering being integrally connected to said building element, protruding upwards from said supporting element and defining an inner room or inner rooms having cross sectional profiles shaped semi-circularly, circularly, semi-elliptically, elliptically, triangularly, rectangularly or shaped in any combinations thereof.

14. A building element according to any of claims 1 to 13, **characterised in that** said building element further comprising reinforcing brackets for providing a rigid gutter member being integrally connected to said building element at longitudinally spaced intervals or connected to said building element at longitudinal ends of said building element for providing reinforcement of connections between a plurality of

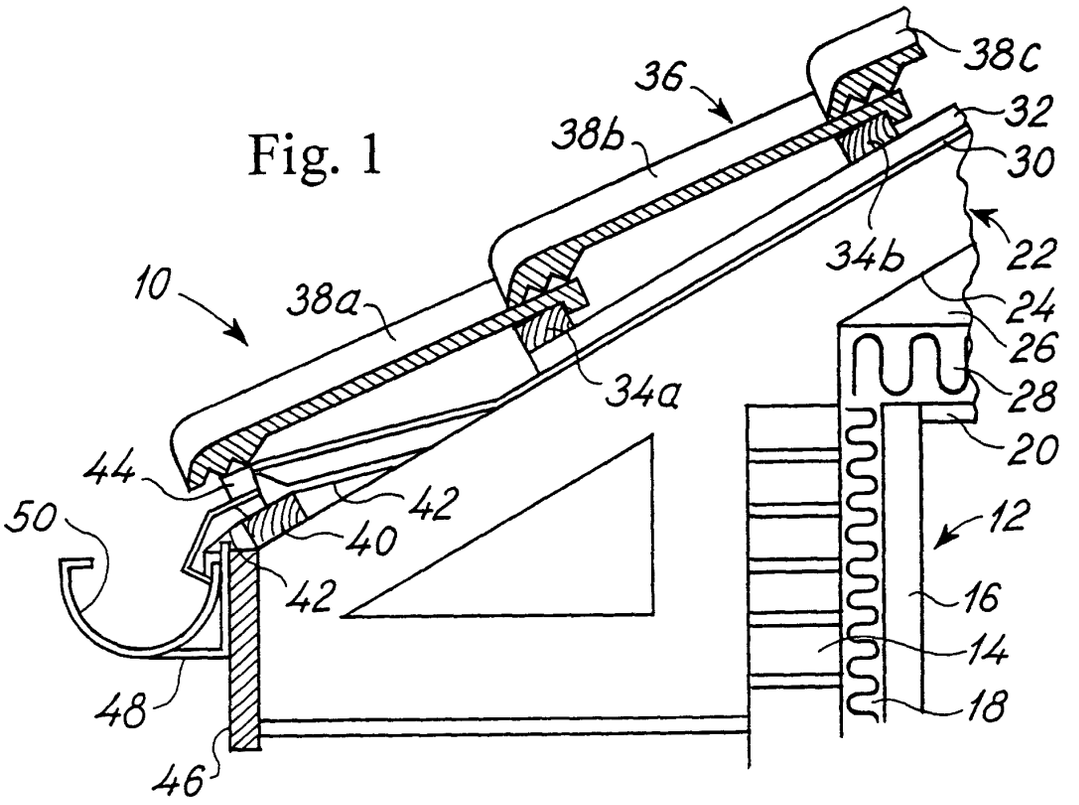
building elements connected end to end.

15. A building element according to any of claims 1 to 14, **characterised in that** said building element further comprising a first integrated link connection located between said first airing element and said supporting element and said first integrated link connection ensuring rotation of said supporting element relative to said first airing element.

16. A building element according to any of claims 9 to 15, **characterised in that** said building element further comprising a second integrated link connection located between said second airing element and said eaves guard member of said gutter member and said second integrated link connection ensuring rotation of said gutter member relative to said second airing element.

17. A building element according to any of claims 1 to 16, **characterised in that** said building element being implemented in corrugated metallic material having corrugations in a plane perpendicular to said longitudinal direction of said building element so as to provide rigidity of said building element.

Fig. 1



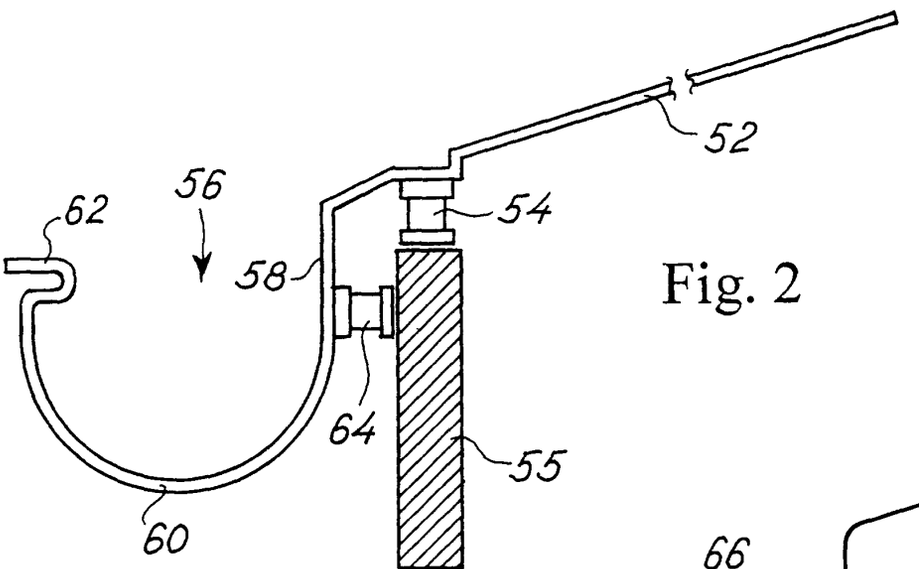
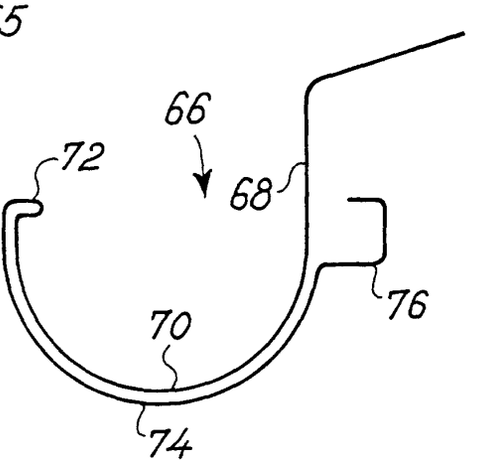


Fig. 2

Fig. 3



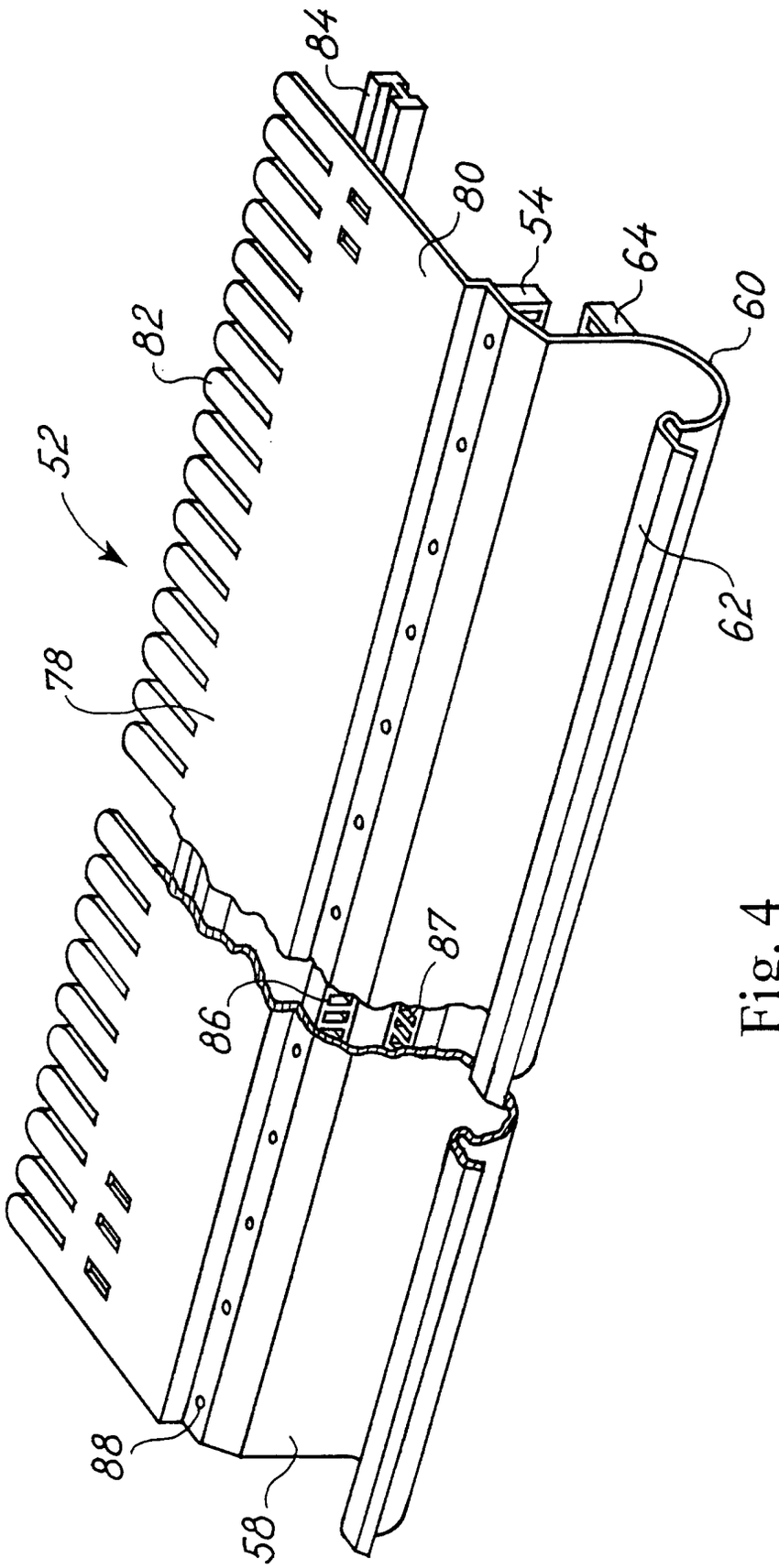


Fig. 4

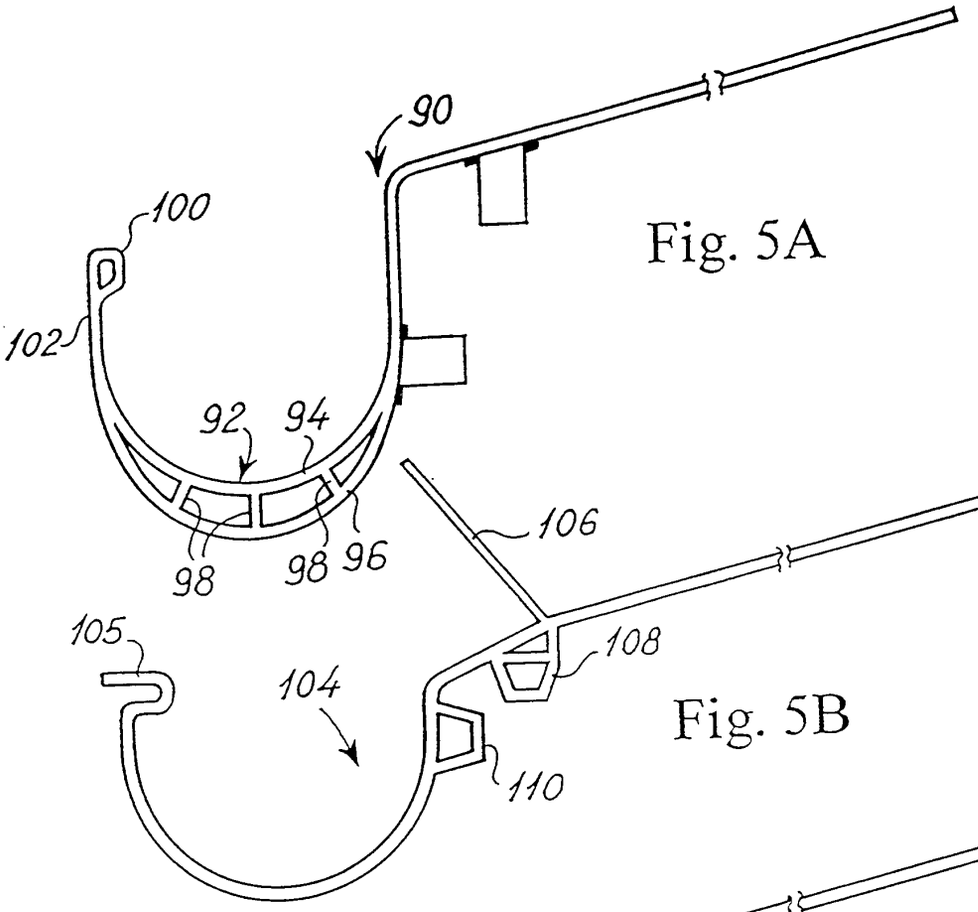


Fig. 5A

Fig. 5B

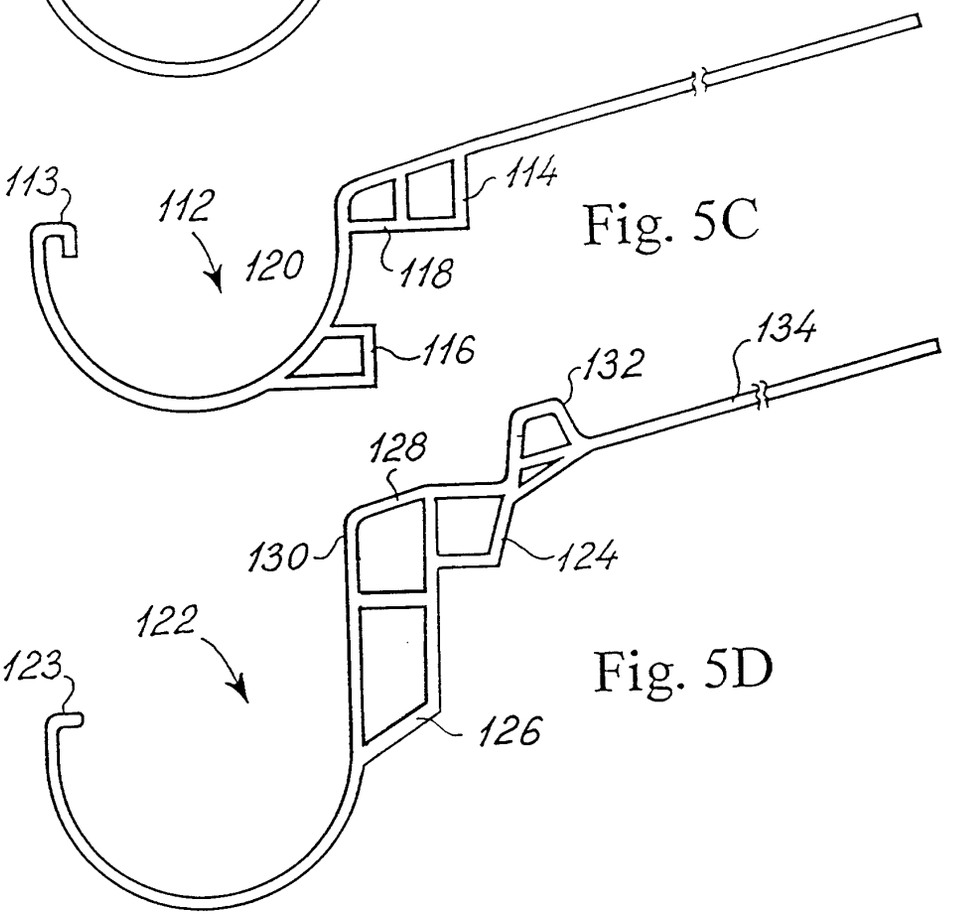


Fig. 5C

Fig. 5D

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 November 2000	Righetti, R

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EUROPEAN SEARCH REPORT

Application Number
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