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(54) **Surface drainage arrangement**
Oberflächenentwässerungseinrichtung
Dispositif de drainage des eaux de surface

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Description

Field of the Invention

[0001] The present invention relates to surface drainage and in particular, linear and point surface drainage arrangements.

Background

[0002] There is an increasing demand for economic, efficient drainage systems for draining surface water (or other fluids) from large catchment areas. Examples include car parks, highways, airport pavements and distribution centres.

[0003] One known form of surface drainage system relies on a number of discreet, spaced inlets in the surface to be drained, which communicate with a common, underlying channel. Examples of such systems can be seen in published UK Patent Applications GB-A-2316428 and GB-A-1456021. A commercial system of this general type has also been sold by Marshalls Mono Ltd under the registered trade mark PORCUIPE.

[0004] These drainage systems result in a reasonably robust installation, as the overlying slab of surface material is substantially continuous, only broken by the discreet, spaced inlets. However, the very nature of these systems, with their discreet, spaced inlets, limits the hydraulic efficiency of the system; the inlet area of the system is limited and, particularly in e.g. storm systems, water may be carried over the surface between the inlets.

[0005] Another known form of drainage system employs a substantially continuous linear slot in the drained surface to serve as the inlet. It is recognised that surface drainage systems employing linear slots are more efficient than those drainage arrangements possessing discreet inlets, as in general they provide a greater inlet area and minimise the volume of water (or other liquid) that can wash over the drained surface without being entrained by the inlet. US Patent US6000881 shows a linear drainage system of this type, as does GB-A-2311549. Both of the systems described in these documents employ a large underground channel which has at its upper side a narrower throat portion defined by two walls extending upwardly to the surface to be drained, where they terminate to form a continuous slot drain in the surface.

[0006] AU199878635 in the name of John Joseph Creighton discloses a surface drainage system comprised of a shallow channel that forms a gutter in a surface, and which is linked by spigots to a drain pipe embedded in the ground below.

[0007] Whilst these continuous linear slot drainage systems offer improved hydraulic efficiency relative to the known drainage systems, these linear slot systems suffer from the drawback that slabs of the surrounding surface material (typically concrete) are cantilevered out over the underground channel at either side of the slot, and this may exert significant loads on the channel itself.

The channel must therefore be extremely robust, either through its own construction or by reinforcement of the surrounding surface material, if the risk of damage to the channel by these high loads during and after installation is to be avoided.

[0008] The skilled person is therefore presented with the dilemma between the robustness of discrete inlet systems and the hydraulic efficiency of the linear drainage systems.

10 **[0009]** A solution to this dilemma is proposed in our copending European Patent Application EP03101666.0.

Summary of the Invention

15 **[0010]** The present invention provides a discrete inlet former according to claim 1 and a linear surface drainage system according to claim 9. Further features are set out in the dependent claims.

20 **[0011]** By enabling the material in which the inlet former is embedded to bridge the structure of the former in this manner, the cantilevered slabs of the conventional linear drainage systems are no longer present. The load of and on the surface material is borne principally by the bridge members as opposed to the inlet former or any underlying structure associated with the installed drainage system.

25 **[0012]** Unlike our previous solution described in the copending application mentioned above, the present invention provides a discrete inlet former which may, but need not be, used in conjunction with an underground drainage channel. The inlet former may be used, for example, to drain water (or other liquid) from a surface into any other form of underlying, manmade or even natural void.

30 **[0013]** The or each transverse opening provides a continuous passage through the former from one side to the other, such that the material in which the former is embedded extends through the opening from one side of the former to the other to form the structural bridge.

35 **[0014]** The inlet former will typically be formed in sections of easily manageable lengths which can be used alone, in combination but spaced apart, or butted against one another to form a substantially continuous slot inlet comprising multiple sections. The easily manageable lengths may consist of section lengths of 1 to 2 metres, however, if the site for the system has sufficient handling capabilities, longer lengths of section may be used.

40 **[0015]** Particularly where the surface in which the inlet former is installed is porous to some extent, it may be desirable for the inlet former to include one or more side inlet openings that allow liquid to drain into the inlet former from one or both of its sides.

45 **[0016]** It will also be desirable in some cases for the inlet former to comprise a filter mounted within the inlet slot to prevent the ingress of large solid objects that might cause a blockage in the inlet former or other elements of a drainage systems with which it is used.

[0017] In another aspect, the invention provides a sur-

face drainage installation comprising an inlet former as set forth above installed in a surface to be drained and a void underlying the inlet former into which fluid can drain through the former.

[0018] The void may be provided by an underlying channel. Alternatively, it may simply be an area intended to catch and store drained liquid for later removal, e.g. by allowing the liquid to leach out from this area. Particularly where there is no channel used, it may be preferred that the void is filled with a high void material (i.e. a structural material having large, interconnecting voids within it).

[0019] The invention also provides a drainage installation comprising an inlet former as set forth above installed in a surface to be drained at the bottom of a gully in the surface. The gully can be pre-formed or formed on site or otherwise. Alternatively the installation may be formed at the base of a slip-formed channel located in the surface to be drained.

Brief Description of the Drawings

[0020] The invention is described below, by way of example, with reference to the accompanying drawing in which:

Figure 1 illustrates a perspective view of an inlet former section according to an embodiment of the present invention;

Figure 2 illustrates a magnified view of an end of the inlet former section shown in fig.1;

Figure 3 shows a cross section of the inlet former section of figs. 1 and 2;

Figure 4 shows a cross section of an inlet former section having a non-continuous structural bridge member;

Figure 5 shows a cross section of the inlet former section having alternative top edges;

Figure 6 illustrates a perspective view of the installation laid in use laid over a high-void material;

Figure 7 shows a cross section of the installation shown in fig.6;

Figure 8 illustrates a perspective view of the installation laid in communication with a pipe;

Figure 9 shows an exploded view of the installation shown in fig.8;

Figure 10 illustrates a perspective view of the installation having a non-continuous structural bridge member laid in communication with a pipe; and

Figure 11 shows an exploded view of the installation shown in fig.10.

Description of an Embodiment

[0021] With reference to figs. 1 to 3, an inlet former section for a linear drainage system in accordance with an embodiment of the present invention will be described.

[0022] The main structure of the inlet former 1 is pro-

vided by two side walls 2, 2', both of which are flanged at top edges and bottom edges to form outwardly extending lips 3, 3', 4, 4' respectively. The walls 2, 2' are spaced laterally from one another and joined by tubular cross-members 5. These tubular elements also form openings that extend through the inlet former from one lateral side to the other.

[0023] At their upper end, the spaced walls define a longitudinal slot 6 designed, in use, to collect water from a surface in which the inlet former is installed.

[0024] The lower ends of the walls are spaced further from one another than the upper ends, so that the channel they define flares downwardly. This helps to prevent any solid material that enters through the slot becoming wedged in this channel.

[0025] A filter member 7, in this example a mesh material, is mounted within the channel, supported by the tubular cross-members 5. This filter serves to prevent large solid objects passing through the inlet former. It is designed to be removable through the slot at the upper end of the former for cleaning.

[0026] The spaces within the former defined between the walls and the tubular cross-members serve as conduits through which liquid that drains into the slot can pass through the inlet former out of its lower end.

[0027] Each of the former walls also has a series of side inlet openings 8 spaced along their length, between the tubular cross-members. These allow water to drain into the channel defined by the walls from either side of the inlet former.

[0028] The walls of the inlet former 1, the tubular cross-members 5 and the filter member 6 may be formed of any of a number of appropriate materials including, for example sheet metal (e.g. steel), cast metal (e.g. iron), any other variety of plastics materials or a combination of these materials.

[0029] The inlet former may be manufactured as a single section or as a number of separate components to be assembled post-manufacture. For example, each wall of the former may be manufactured as a separate component formed integrally with a portion or complete ones of the tubular cross-members. As noted above, the filter member 6 will normally be a separate component in order that it can be removed if desired.

[0030] End caps 9 may be provided to seal the open ends defined by the space between the former walls. These also allow the length or effective length of the former to be adjusted depending on the site requirements.

[0031] Fig.4 illustrates an alternative embodiment in which the passage through the former 1 provided by the tubular elements 5 may be interrupted by a vertical plate 10, creating two opposed, blind lateral openings having face to face contact, one opening to either side of the former.

[0032] Fig. 5 shows a former 1 having a rolled edge 11, 11' which may be used when the former is for use with asphalt and/or block surfacing materials.

[0033] Referring to figs. 6 and 7, an exemplary linear drainage Installation employing the inlet former of figs. 1 to 3 is now described.

[0034] A void is formed (e.g. excavated) in the ground in the area that is to be drained. In this example, the void in the ground is lined with a water permeable material, such as a geotextile material, that allows water to pass in a controlled fashion from within the void to the surrounding ground.

[0035] The void itself is filled with a high void material 12. Examples of appropriate materials include STORM-CELL™ provided by Hydro International plc

[0036] A slab surface material 13 e.g. of concrete, is laid over the underlying ground and the void. The inlet former 1 is embedded in the slab with its upper end level with the surface of the slab and its lower end opening into the high void material. In this manner a slot drain is formed in the surface, water draining from the surface through the inlet former into the high void material below.

[0037] When there is, for example, rainfall of high intensity, the rainwater will drain quickly through the slot 6 into the high void material 12 and then, over a period of time, soak away through the geotextile material into the surrounding ground. Alternatively the geotextile material could be impermeable for deliberate water retention.

[0038] On installation, the inlet former is located above the underground void and secured in place by some suitable means. The broad flanges 2, 2' at the lower end of the former walls can be used to secure the former in place (alternatively, in place of such flanges, a series of broad feet might be provided). The surface slab material 13 (e.g. concrete) is then poured to form the surface and embed the inlet former within it. The surface material flows through the tubular cross-members 5 of the inlet former to create structural bridges which serve to support the slab to either side of the inlet former, alleviating loading on the inlet former and the underlying high void material.

[0039] As will be appreciated by the skilled person, the embodiment described above is given by way of example and the invention is not limited to that which has been specifically described. For instance, other installations employing embodiments of the inlet former of the invention may use an underground drainage channel in place of the high void material. In such cases the inlet former can be adapted to be secured to an inlet opening of the channel.

[0040] Indeed figs. 8 and 9 illustrate an inlet former 1 in combination with an underlying pipe 14. The pipe is provided with cut outs 15 which can be aligned with the location of the conduits in the former defined between the walls 2, 2' and the tubular cross-members 5 to permit the passage of liquid into the slot and down into the pipe via the conduit.

[0041] The pipe 14 may be made from any suitable rigid or strengthened material, but preferably is made from corrugated steel, spirally wound steel, a plastic material or concrete.

[0042] Figs. 10 and 11 also illustrate an inlet former 1 in combination with an underlying pipe 14. The pipe is provided with cut outs 15 which can be aligned with the location of the conduits in the former 1 defined between the walls 2, 2' and tubular cross-members 5 to permit the passage of liquid into the slot and down into the pipe via the conduit. As shown, the tubular elements 5 are interrupted by a vertical plate 10, creating two opposed, blind lateral openings having face to face contact, one opening to either side of the former.

Claims

1. A discrete inlet former (1) for a surface drainage system comprising a longitudinal slot (6) that lies, in use, in a surface to be drained and a conduit via which liquid can drain, in use, from the surface through the former (1), **characterised in that** the former (1) comprises one or more transverse openings (5) into which a material in which the former (1) is embedded, in use, can extend from one or both sides of the former (1) to form a structural bridge member, wherein the transverse opening (5) or at least one of the transverse openings (5) provides, in use, a continuous passage from one side of the former to the other and wherein the main structure of the inlet former (1) is provided by two side walls, both of which are flanged at bottom edges to form outwardly extending lips (4,4') or a series of broad feet, which can be used to secure the inlet former (1) on an underlying longitudinal channel (14).
2. An inlet former (1) as claimed in Claim 1, wherein the inlet former (1) is configured for point drainage.
3. An inlet former (1) as claimed in Claim 1, wherein the inlet former (1) is configured for linear drainage.
4. An inlet former (1) as claimed in any one of Claims 1 to 3, wherein the transverse opening (5) or at least one of the transverse openings (5) is divided by a wall that is substantially incompressible in the lateral direction.
5. An inlet former (1) as claimed in Claim 4, wherein the wall is located substantially centrally of the inlet former (1).
6. An inlet former (1) as claimed in any one of the preceding claims, wherein the inlet former (1) is unitary.
7. An inlet former as claimed in any one of the preceding claims, wherein the inlet former (1) has one or more side inlet openings (8) which allows liquid to drain into the inlet former (1).
8. An inlet former as claimed in any one of the preceding

claims, wherein a filter (6) is mounted, in use, in the inlet former (1).

9. A linear surface drainage system comprising a discrete inlet former and a longitudinal channel (14), wherein the inlet former (1) is configured to be secured to the longitudinal channel (14) so that, in use, the longitudinal channel (14) underlies the inlet former (1) and is in fluid communication with the former (1) in order that fluid can drain through the former into this underlying channel (14) wherein the inlet former (1) comprises a longitudinal slot (6) that lies, in use, in a surface to be drained and a conduit via which liquid can drain, in use, from the surface through the former (1), **characterised in that** the former (1) comprises one or more transverse openings (5) into which a material in which the former (1) is embedded, in use, can extend from one or both sides of the former (1) to form a structural bridge member, wherein the transverse opening (5) or at least one of the transverse openings (5) provides, in use, a continuous passage from one side of the former to the other and wherein the main structure of the inlet former (1) is provided by two side walls, both of which are flanged at bottom edges to form outwardly extending lips (4,4') or a series of broad feet, which can be used to secure the inlet former (1) to the underlying longitudinal channel (14).
10. A linear surface drainage system comprising a discrete inlet former as claimed in any one of Claims 2 to 8.

Patentansprüche

1. Einzelne Einlaufformvorrichtung (1) für ein Oberflächenentwässerungssystem, umfassend einen länglichen Schlitz (6), der bei der Verwendung in einer Fläche liegt, die entwässert werden soll, und einen Kanal, durch den bei der Verwendung Flüssigkeit von der Fläche durch die Einlaufformvorrichtung (1) ablaufen kann, **dadurch gekennzeichnet, dass** die Formvorrichtung (1) eine oder mehrere Queröffnungen (5) umfasst, in die sich ein Material, in das die Einlaufformvorrichtung (1) bei der Verwendung eingebettet ist, aus einer oder aus beiden Seiten der Einlaufformvorrichtung (1) erstrecken kann, um ein strukturelles Brückenelement zu bilden, wobei die Queröffnung (5) oder mindestens eine der Queröffnungen (5) bei der Verwendung einen kontinuierlichen Durchgang aus einer Seite der Formvorrichtung zur anderen bereitstellt, und wobei die Hauptstruktur der Einlaufformvorrichtung (1) durch zwei Seitenwände, welche mit den Unterkanten geflanscht werden, um nach außen gerichtete Lippen (4, 4') oder eine Reihe von breiten Füßen zu formen, gebildet wird, die dazu benutzt werden können, die

Einlaufformvorrichtung (1) an einen darunter liegenden Längskanal (14) anzubringen.

2. Einlaufformvorrichtung (1) nach Anspruch 1, wobei die Einlaufformvorrichtung (1) für eine Punktentwässerung konfiguriert ist.
3. Einlaufformvorrichtung (1) nach Anspruch 1, wobei die Einlaufformvorrichtung (1) für eine Entwässerungsrinne konfiguriert ist.
4. Einlaufformvorrichtung (1) nach einem der Ansprüche 1 bis 3, wobei die Queröffnung (5) oder mindestens eine der Queröffnungen (5) durch eine Wand getrennt ist, die im Wesentlichen in der seitlichen Richtung nicht zusammendrückbar ist.
5. Einlaufformvorrichtung (1) nach Anspruch 4, wobei sich die Wand im Wesentlichen in der Mitte der Einlaufformvorrichtung (1) befindet.
6. Einlaufformvorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Einlaufformvorrichtung (1) unitär ist.
7. Einlaufformvorrichtung (1) nach einem der vorhergehenden Ansprüche, wobei die Einlaufformvorrichtung (1) eine oder mehrere seitliche Einlassöffnungen (8) aufweist, wodurch Flüssigkeit in die Einlaufformvorrichtung (1) ablaufen kann.
8. Einlaufformvorrichtung nach einem der vorhergehenden Ansprüche, wobei bei der Verwendung ein Filter (6) in der Einlaufformvorrichtung (1) montiert ist.

9. Entwässerungssystem mit linearer Oberfläche, umfassend eine einzelne Einlaufformvorrichtung und einen Längskanal (14), wobei die Einlaufformvorrichtung (1) dergestalt konfiguriert ist, dass sie an dem Längskanal (14) angebracht werden kann, so dass bei der Verwendung unter der Einlaufformvorrichtung (1) liegt und in Flüssigkeitsverbindung mit der Einlaufformvorrichtung (1) steht, damit Flüssigkeit durch die Einlaufformvorrichtung in diesen darunter liegenden Kanal (14) ablaufen kann, wobei die Einlaufformvorrichtung (1) einen länglichen Schlitz (6) umfasst, der bei der Verwendung in einer Fläche liegt, die entwässert werden soll und einen Kanal, durch den bei der Verwendung Flüssigkeit von der Fläche durch die Einlaufformvorrichtung (1) ablaufen kann, **dadurch gekennzeichnet, dass** die Formvorrichtung (1) eine oder mehrere Queröffnungen (5) umfasst, in die sich ein Material, in das die Einlaufformvorrichtung (1) bei der Verwendung eingebettet ist, aus einer oder aus beiden Seiten der Einlaufformvorrichtung (1) erstrecken kann, um ein strukturelles Brückenelement zu bilden, wobei die

Queröffnung (5), oder mindestens eine der Queröffnungen (5), bei der Verwendung einen kontinuierlichen Durchgang aus einer Seite der Formvorrichtung zur anderen bereitstellt, und wobei die Hauptstruktur der Einlaufformvorrichtung (1) durch zwei Seitenwände (2, 2'), welche mit den Unterkanten geflanscht werden, um nach außen gerichtete Lippen (4, 4') oder eine Reihe von breiten Füßen zu formen, gebildet wird, die dazu benutzt werden können, die Einlaufformvorrichtung (1) an einen darunter liegenden Längskanal (14) anzubringen.

10. Entwässerungssystem mit linearer Oberfläche, umfassend eine Einlaufformvorrichtung nach einem der Ansprüche 2 - 8.

Revendications

1. Formeur d'entrée discret (1) pour un système de drainage de surface comprenant une fente longitudinale (6) qui se trouve, durant l'utilisation, dans une surface à drainer et un conduit par l'intermédiaire duquel un liquide peut être drainé, durant l'utilisation, à partir de la surface à travers le formeur (1), **caractérisé en ce que** le formeur (1) comprend une ou plusieurs ouvertures transversales (5) dans lesquelles un matériau dans lequel le formeur (1) est incorporé, durant l'utilisation, peut s'étendre à partir d'un ou des deux côtés du formeur (1) pour former un élément pont structurel, dans lequel l'ouverture transversale (5) ou au moins une des ouvertures transversales (5) fournit, durant l'utilisation, un passage continu d'un côté du formeur à l'autre et dans lequel la structure principale du formeur d'entrée (1) est fournie par deux parois latérales, toutes les deux bridées au niveau de bords inférieurs pour former des lèvres s'étendant vers l'extérieur (4, 4') ou une série de pieds larges, lesquels peuvent être utilisés pour fixer le formeur d'entrée (1) sur un canal longitudinal sous-jacent (14).
2. Formeur d'entrée (1) selon la revendication 1, dans lequel le formeur d'entrée (1) est configuré pour un drainage ponctuel.
3. Formeur d'entrée (1) selon la revendication 1, dans lequel le formeur d'entrée (1) est configuré pour un drainage linéaire.
4. Formeur d'entrée (1) selon une quelconque des revendications 1 à 3, dans lequel l'ouverture transversale (5) ou au moins une des ouvertures transversales (5) est divisée par une paroi qui est sensiblement incompressible dans le sens latéral.
5. Formeur d'entrée (1) selon la revendication 4, dans lequel la paroi est positionnée sensiblement au cen-

tre du formeur d'entrée (1).

6. Formeur d'entrée (1) selon une quelconque des revendications précédentes, dans lequel le formeur d'entrée (1) est unitaire.
7. Formeur d'entrée (1) selon une quelconque des revendications précédentes, dans lequel le formeur d'entrée (1) comporte une ou plusieurs ouvertures d'entrée latérales (8) qui permettent à un liquide d'être drainé dans le formeur d'entrée (1).
8. Formeur d'entrée selon une quelconque des revendications précédentes, dans lequel un filtre (6) est monté, durant l'utilisation, dans le formeur d'entrée (1).
9. Système de drainage de surface linéaire comprenant un formeur d'entrée discret et un canal longitudinal (14), dans lequel le formeur d'entrée (1) est configuré pour être fixé au canal longitudinal (14) de telle sorte que, durant l'utilisation, le canal longitudinal (14) soit sous-jacent au formeur d'entrée (1) et soit en communication fluïdique avec le formeur (1) afin qu'un fluide puisse être drainé à travers le formeur dans ce canal sous-jacent (14), dans lequel le formeur d'entrée (1) comprend une fente longitudinale (6) qui se trouve, durant l'utilisation, dans une surface à drainer et un conduit par l'intermédiaire duquel un liquide peut être drainé, durant l'utilisation, à partir de la surface à travers le formeur (1), **caractérisé en ce que** le formeur (1) comprend une ou plusieurs ouvertures transversales (5) dans lesquelles un matériau dans lequel le formeur (1) est incorporé, durant l'utilisation, peut s'étendre à partir d'un ou des deux côtés du formeur (1) pour former un élément pont structurel, dans lequel l'ouverture transversale (5) ou au moins une des ouvertures transversales (5) fournit, durant l'utilisation, un passage continu d'un côté du formeur à l'autre et dans lequel la structure principale du formeur d'entrée (1) est fournie par deux parois latérales, toutes les deux bridées au niveau de bords inférieurs pour former des lèvres s'étendant vers l'extérieur (4, 4') ou une série de pieds larges, lesquels peuvent être utilisés pour fixer le formeur d'entrée (1) au canal longitudinal sous-jacent (14).
10. Système de drainage de surface linéaire comprenant un formeur d'entrée discret selon une quelconque des revendications 2 à 8.

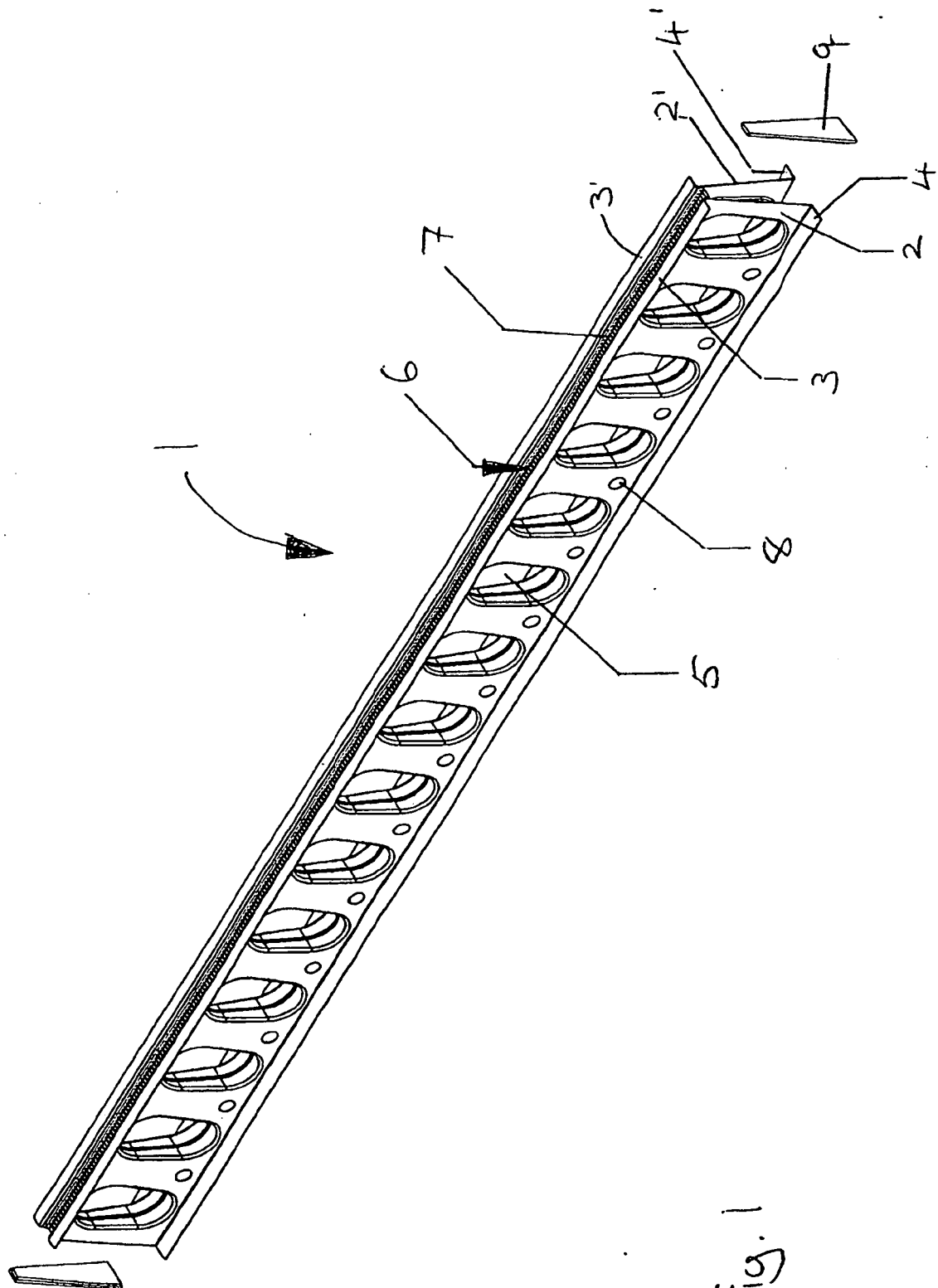


Fig. 1

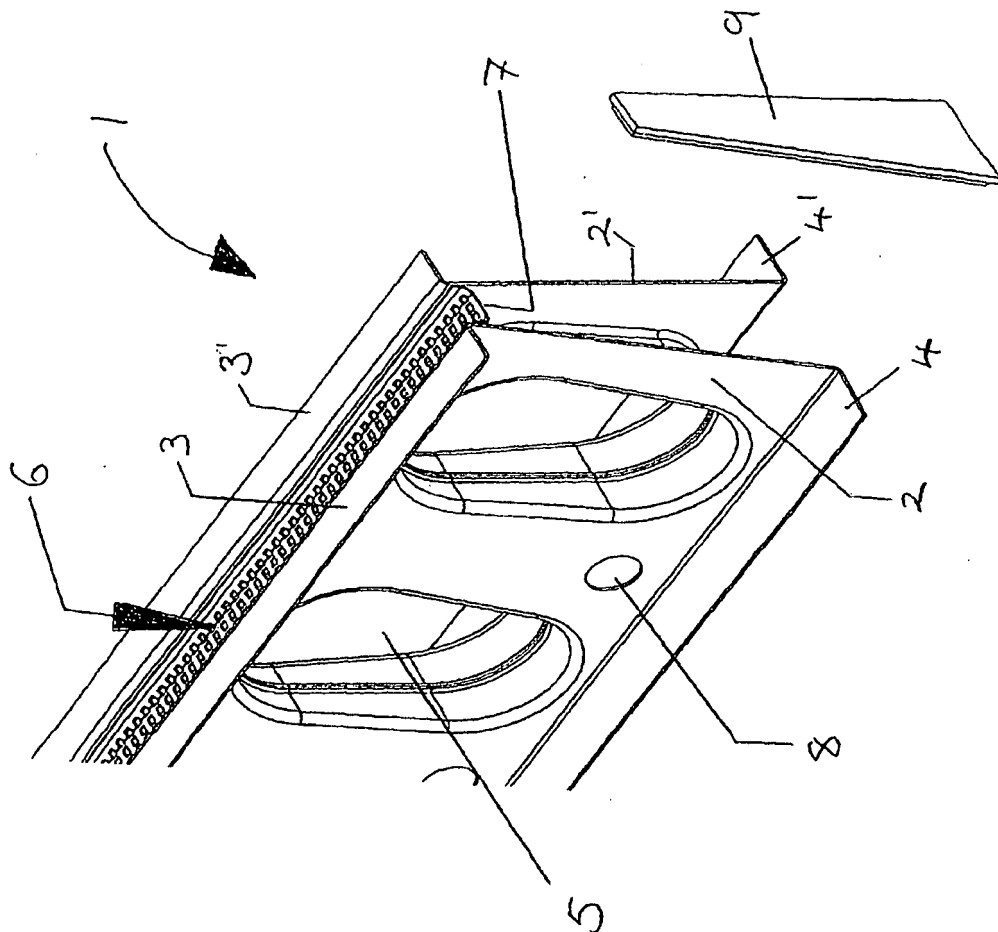


Fig. 2

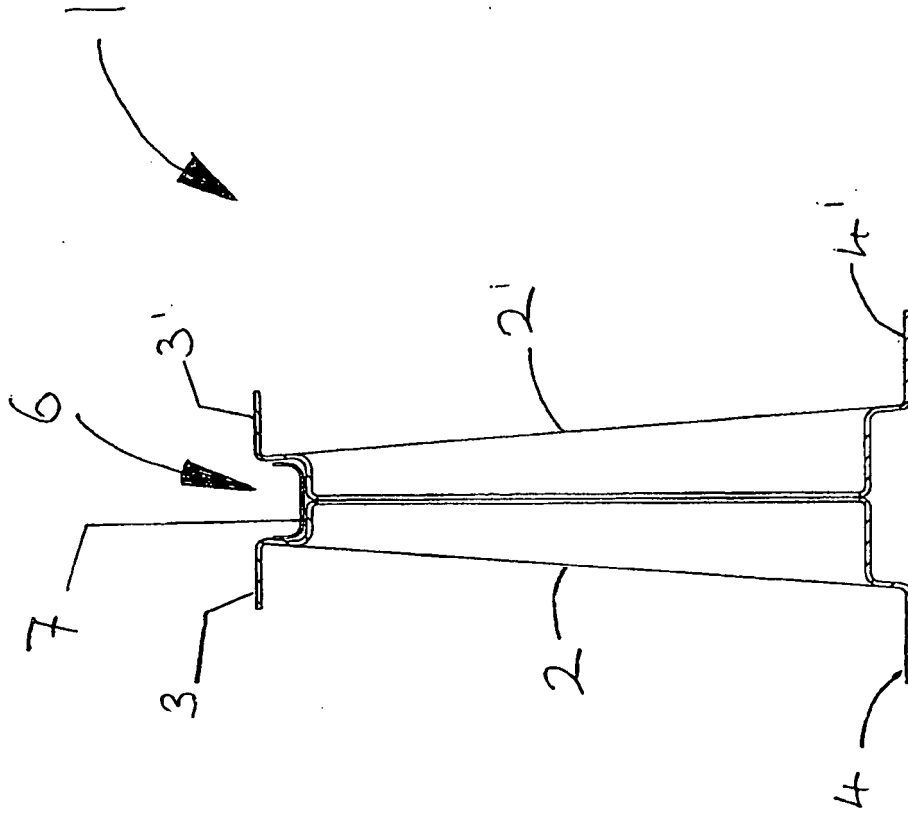


Fig. 3

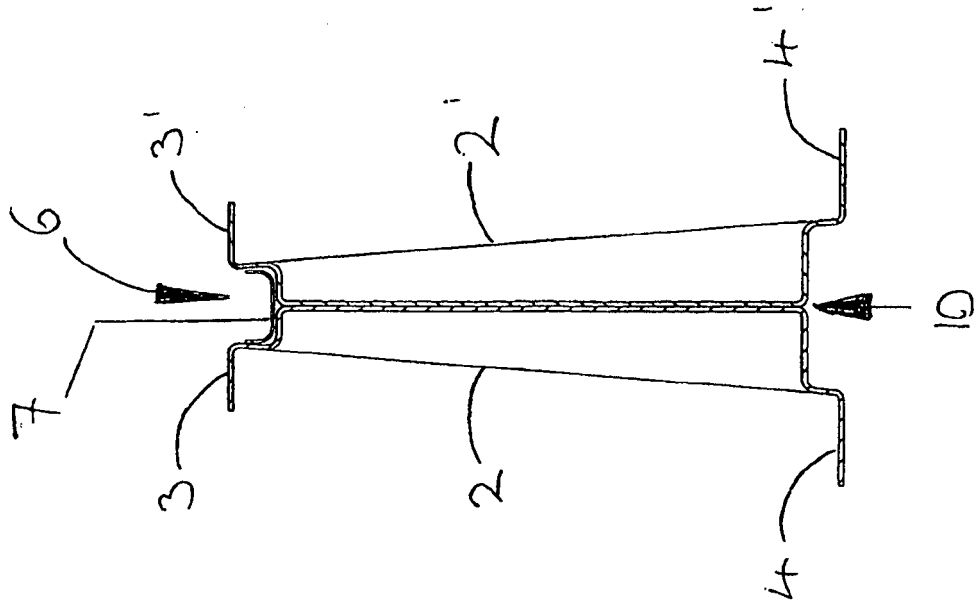


Fig. 4

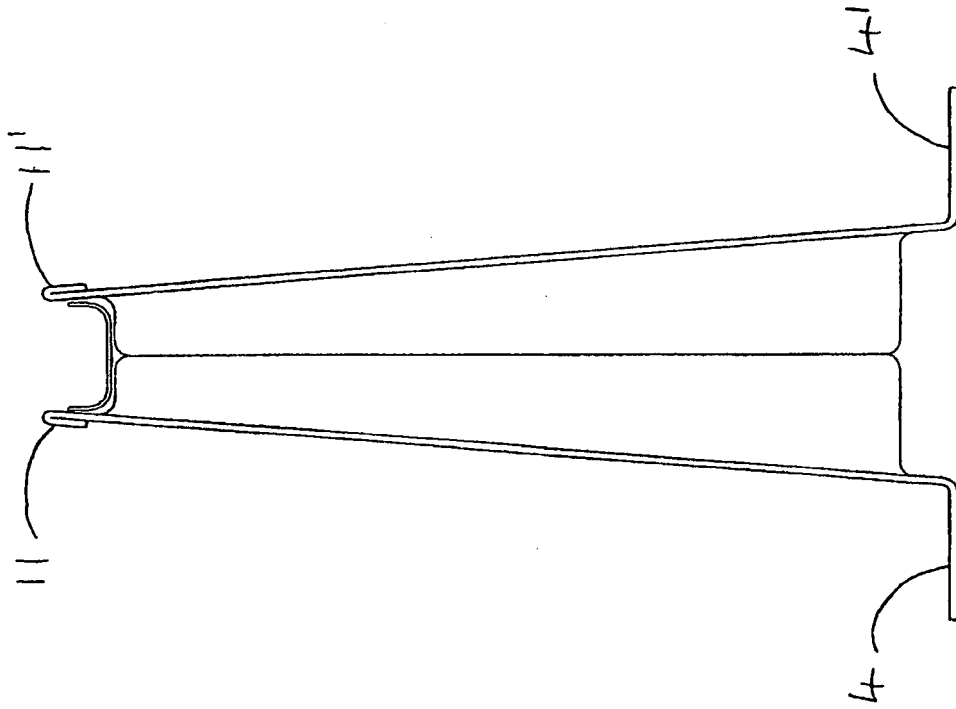


Fig. 5

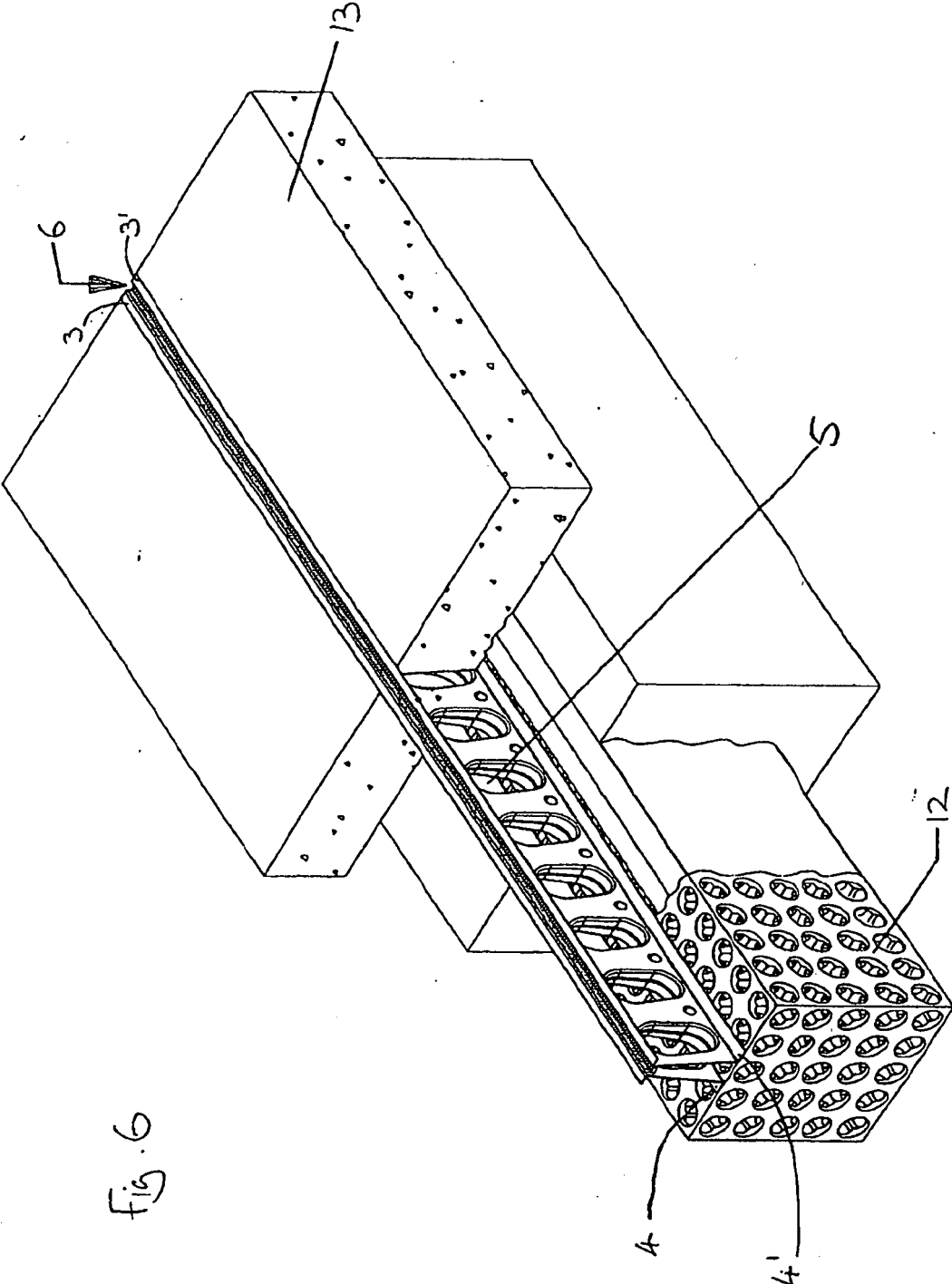


Fig. 6

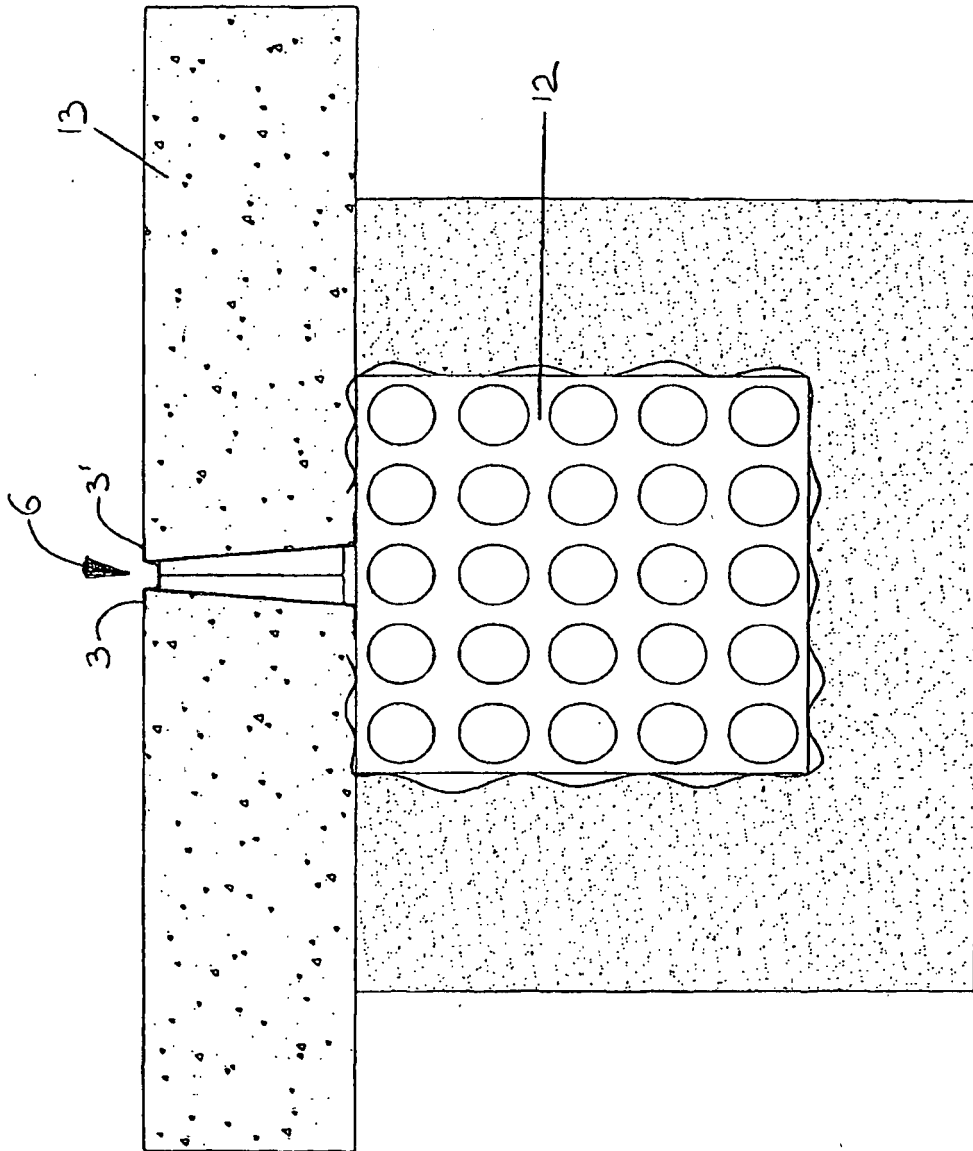


Fig. 7

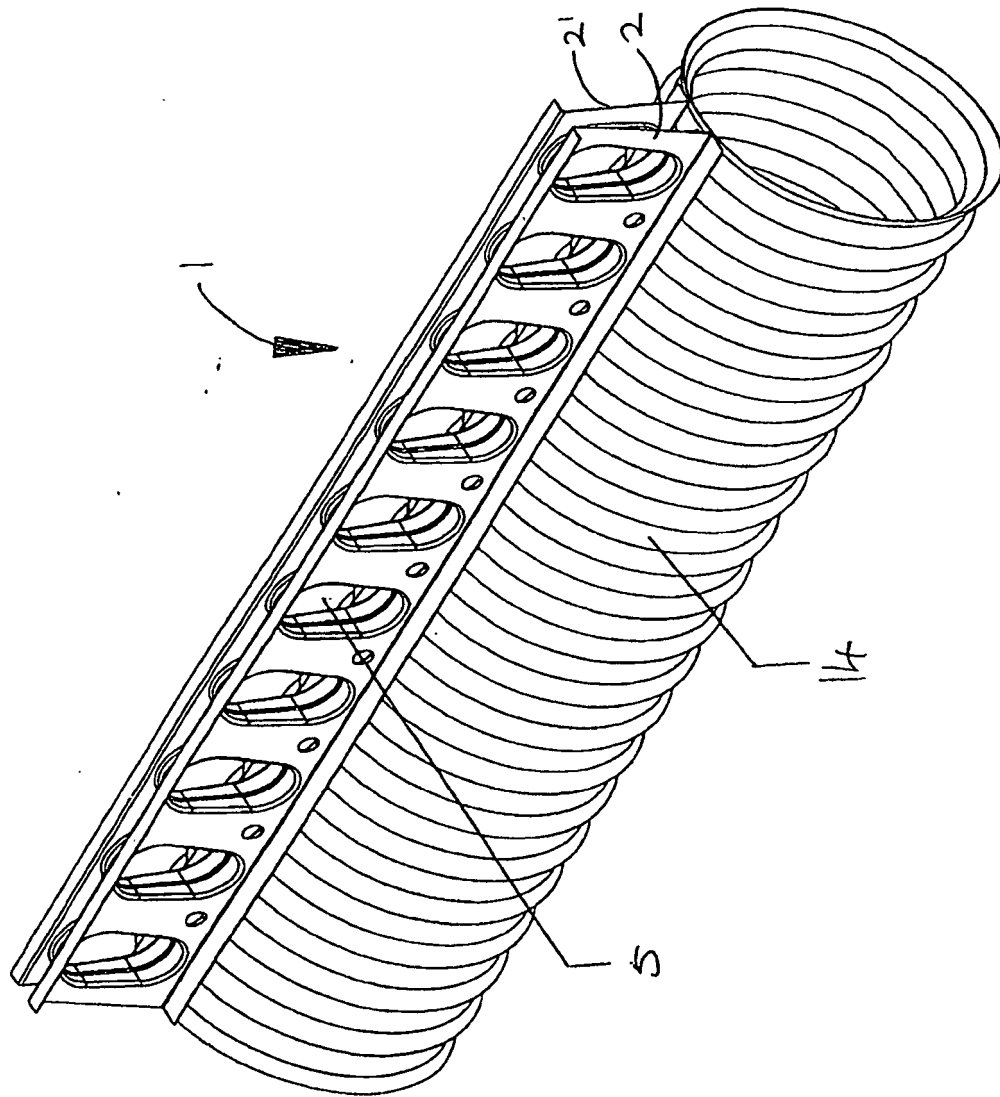


Fig. 8

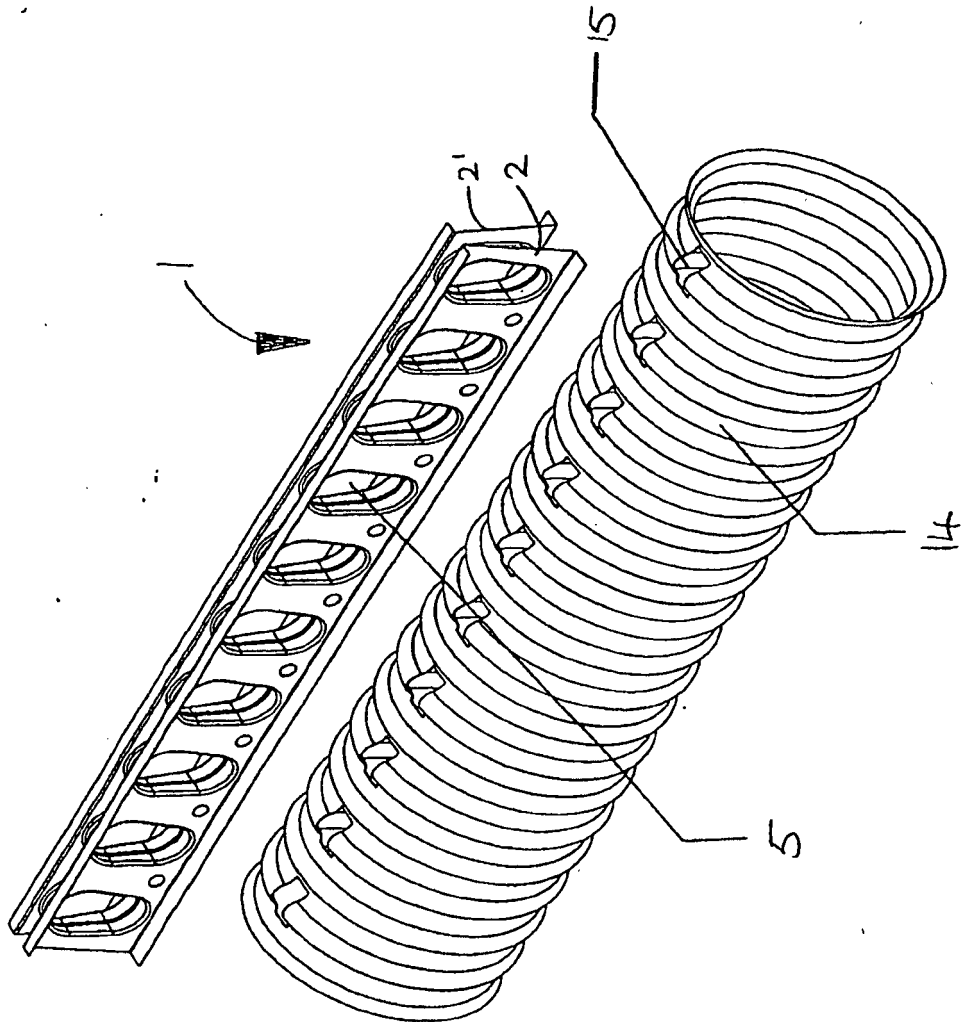


Fig. 9

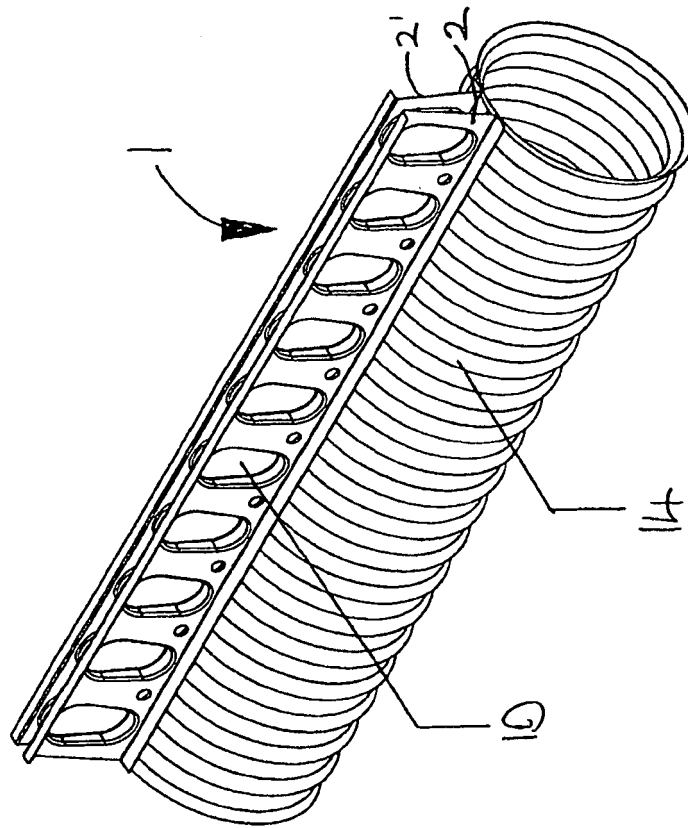


Fig. 10

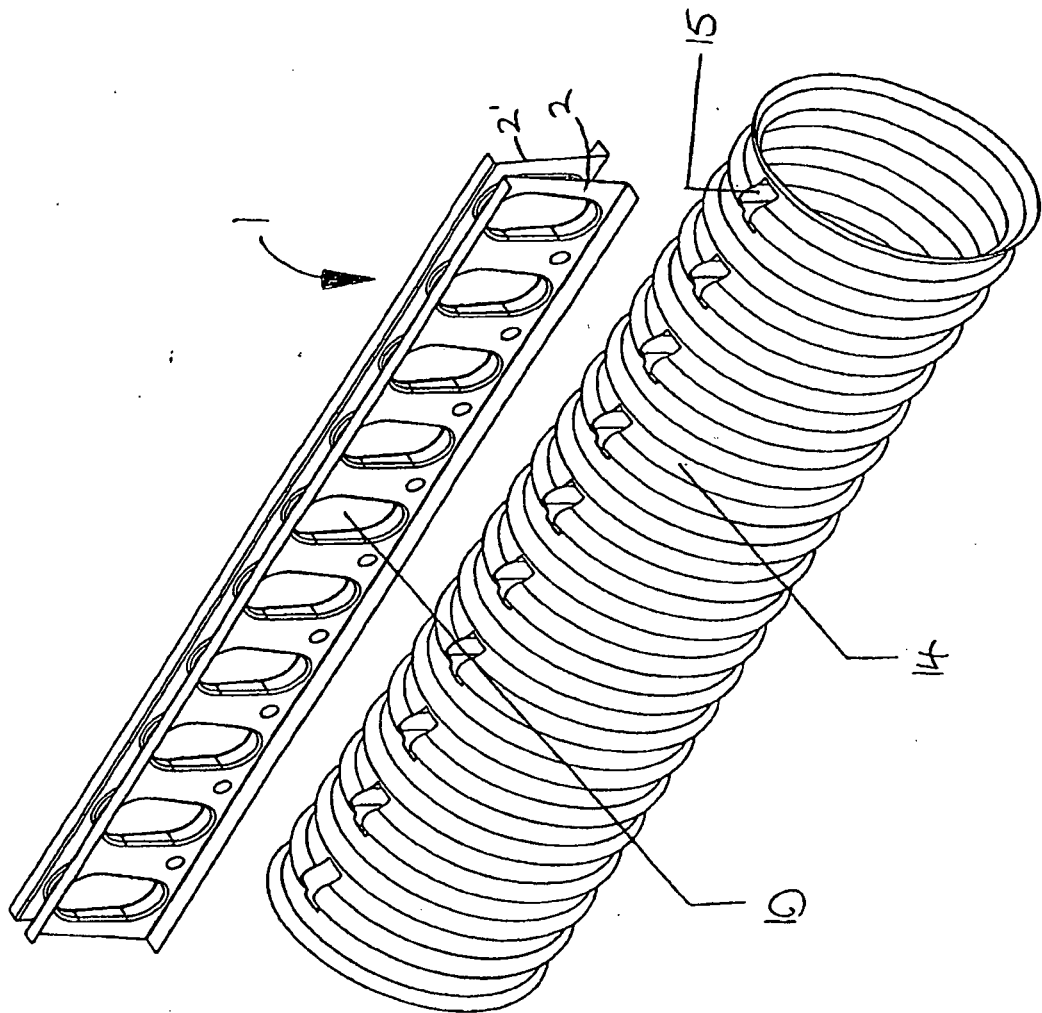


Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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