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Señora Jefe de la
DIVISION DE NUEVAS CREACIONES
Superintendencia de Industria y Comercio
E. S. D.

Trámite : 002
Evento : 001
Actuación : 538

Referencia : Expediente No. 06.066.496
Asunto : Solicitud de Patente para **ELEMENTO CONSTRUCTIVO FORMADO DE UNA LAMINA DE ESPESOR CONSTANTE, CUYA SECCION COMPRENDE UNA REGION DESPLEGADA CON UN ELEMENTO ROTADO 180° RESPECTO A SU ROTACION ANTES DE SER DESPLEGADO; ESTE DESPLEGADO PERMITE AHORRAR MATERIAL EN LA CONSTRUCCION DE ELEMENTOS CONSTRUCTIVOS COMO PERFILES, SIN PERJUDICAR SU DESEMPEÑO ESTRUCTURAL.**
Solicitante : **JOSE ROJAS UBILLA**
Clase : F16S 001/000
Publicada en : La Gaceta No. 588 Del 31 de enero de 2008
Fecha de Solicitud : 10 de julio de 2006

1. Yo, Emilio FERRERO, identificado como aparece al pie de mi firma, actuando como apoderado en el asunto de la referencia, atentamente, solicito se efectúe el examen de patentabilidad de la solicitud en referencia. Para tal efecto presento junto con este escrito el recibo por valor de \$420.000.00, que corresponde a la tasa fijada según lo dispuesto en la resolución No. 44372 de 26 de diciembre de 2007.

2. Ruego atentamente a la Señora Jefe se sirva ordenar que se anexe este recibo para que se efectúe dicho examen y se continúe con el trámite de la solicitud.

Señora Jefe,


EMILIO FERRERO
T.P.A. No. 31.929

2. Objeto de la invención

Título de la solicitud: *Elemento constructivo, formado de una lámina de espesor constante, cuya sección comprende una región desplegada con un elemento rotado 180° respecto a su rotación antes de ser desplegado; este desplegado permite ahorrar material en la construcción de elementos constructivos como perfiles, sin perjudicar su desempeño estructural*, folio 1.

El objeto de la presente solicitud de patente de invención consiste en suministrar un perfil con forma de U con los extremos de las alas o brazos doblados hacia adentro y en cuya parte central o alma se hace un troquelado con forma de $\subset$ y de $\supset$, alternadamente, y que están parcialmente traslapadas.

El problema planteado en esta solicitud es satisfacer la necesidad de obtener un perfil en el cual el alma sea capaz de soportar los mismos esfuerzos que las alas del perfil.

Para solucionar este problema técnico la solicitud en estudio proporciona un perfil en el cual el alma se troquela de tal manera que tienen un patrón regular alternado con partes dobladas sobre sí mismas (plegadas o rotadas en 180°) que, en parte se traslapan.

Clasificación Internacional de Patentes (IPC): E04C 3/32, 3/04

3. De la solicitud de Patente

Descripción (artículo 28 D. 486)

Durante el análisis del texto de la descripción y de las ilustraciones anexadas, se observaron los siguientes defectos:

- 1) Los datos bibliográficos de la carátula no corresponden enteramente con los del petitorio (folio 1).
- 2) El título o nombre de la invención, folio 1, es relativamente extenso, y además, no corresponde con lo que se reclama en las reivindicaciones (Un perfil de sección transversal esencialmente constante). Se le sugiere al solicitante que reduzca el título a unas diez palabras.
- 3) En la página 1, folio 29, aparece por primera vez la expresión *y/o*. Al respecto, el *Diccionario panhispánico de dudas* de la Real Academia Española y de la Asociación de Academias de la Lengua Española, primera edición, octubre de 2005, página 681, dice:
y/o: Hoy es frecuente el empleo conjunto de las conjunciones copulativa y disyuntiva separadas por una barra oblicua, calco del inglés «and/or», con la intención de hacer explícita la posibilidad de elegir entre la suma o la alternativa de dos opciones: «Se necesitan traductores de inglés y/o francés». Se olvida que la conjunción 'o' puede expresar en español ambos valores conjuntamente.

El examinador ha subrayado la última frase porque es particularmente aplicable a este caso.

- 4) La reseña de las figuras se encuentra en la página 8, folio 36, al final del capítulo descriptivo, donde no es de ninguna utilidad. Se le sugiere al solicitante que la inserte en la página 2, folio 30, inmediatamente antes del párrafo que se inicia con la expresión *En una primera modalidad, la invención...*

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US85/00799 (22) International Filing Date: 2 May 1985 (02.05.85) (71) Applicant: DONN INCORPORATED [US/US]; 1000 Crocker Road, Westlake, OH 44145 (US). (72) Inventor: SHIREY, Richard ; 2799 Lear Nagle, Avon, OH 44011 (US). (74) Agents: CORSO, Joseph, J. et al.; Pearne, Gordon, Sessions, McCoy, Granger & Tilberry, 1200 Leader Building, Cleveland, OH 44114 (US). (81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE, DE (European patent), FR (European patent), GB, GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).		Published With international search report.
(54) Title: EXPANDED METAL PRODUCTS		
(57) Abstract		
A novel and improved, expanded metal along with novel and improved products incorporating such expanded metal. The expanded metal is formed from a piece of sheet metal which is lanced (31, 32) in nested arrays to that when the metal is expanded, diagonal legs (38) are connected to the remaining portion of the sheet metal by folds (36, 37). After the expanding operation, the legs are substantially coplanar with the adjacent portions of the piece of sheet metal, and the only material deformation of the metal occurs along the folds. The illustrated legs and adjacent projections (39, 41), which are connected to the legs by folds, are curved so that the centers of the legs have a maximum width. The expanded metal is illustrated incorporated into various types of framing members used to position interior panels of building structures, such as drywall studs (10) floor tracks for drywall construction, and intersection tracks. Also disclosed are grid tees for suspension ceiling and wall molding members for suspension ceilings.		

D2

DETAILED DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 5 illustrate a preferred embodiment of a sheet metal drywall stud in accordance with this invention. Such stud 10 includes a pair of opposed, parallel flanges 11 and 12 which are interconnected by an expanded metal web 13. At the extremities of the flanges 11 and 12, remote from the web 13, the metal forming the stud is bent inwardly to provide short stiffening tabs 14 and 16.

Except for the fact that the web is formed of expanded metal as discussed in detail below, such a stud is conventional in structure and is installed between parallel rows 17 and 18 of wall panels which may be, for example, drywall panels. Such panels are illustrated in phantom in FIG. 1. In a typical installation, a joint 19 is provided between two edge-abutting panels 21 and 22, with the joint being located substantially midway along the width of the flange 11, and the flange 12 is secured to the panel 23 at a point spaced from the edges of such panel. Additional studs are generally located at the joints between the panel 23 and the next adjacent panels in the row 18.

The various panels are secured to the flanges by any suitable means, which may include sheet metal fasteners 24, which are driven through the panels and into the flanges to secure the panels to the flanges. In some instances, adhesive may be used to secure the panels to the flanges. However, when sheet metal screws 24 are used to secure the panels in place, it is customary to use a screw of the type which does not require a pre-drilled hole and which actually cuts or pierces a hole in

the associated flange and then threads its way into the hole to form a threaded connection between the metal of the flange and the screw. DZ

During the driving of the screw into its installed position, it is customary to use a power drive and to exert a substantial axial force on the screw so that it will form its own hole in the flange and thread itself into the hole thus formed. This axial force, because it is offset from the plane of the web 13, exerts both compressive and bending forces on the web, creating stresses therein both in compression and bending. Consequently, the web 13 must provide sufficient stability or stiffness to be capable of withstanding such forces, at least during the initial driving of the screws.

Some deflection of the web during the actual driving operation is permissible; however, the material forming the web should not be stressed beyond its elastic limit so that once the screws are seated and the flanges returned to a parallel condition against the associated panels, the web 13 remains substantially planar and, in the illustrated embodiment, is contained in a plane perpendicular to the plane of the panels on each side of the stud. When the web components remain substantially planar, the stud is capable of resisting substantial forces against the wall panels without failure.

In an installed wall in which the stud flanges are secured to the panels, the panels themselves tend to hold the flanges parallel, with the result that forces applied to the wall panels are transmitted to the web which are substantially compressive or tensile in nature, and such forces do not usually result in the application of significant bending forces to the web. Consequently, the most significant stresses on the web 13 after the stud is installed are either in compression or tension.

Reference should now be made to FIGS. 2 and 3, which illustrate the manner in which the material forming the web is expanded to reduce the material content of the web and thereby reduce the material cost of the stud.

FIG. 2 illustrates a portion of the strip of metal 30 used to form the stud 10. Such strip of metal is lanced along overlapping curves 31 and 32, which in the illustrated embodiment are portions of circles of equal radius. The curved lances 31 form a first array 35 of aligned lances extending to ends 33 which are spaced from the adjacent ends 33 and are centrally located within the curved lances 32 but spaced therefrom. Similarly, the curved lances 32 are aligned and form an array of lances each of which extends to an end 34, which are again spaced from each other and are positioned within the curves 31 but spaced therefrom. The spacing between the ends 33 and the ends 34 is equal, and the spacing between the ends 33 and 34 from the curves 32 and 31, respectively, is equal.

After the strip 30 is lanced with the two arrays of lances, the material forming the strip 30 is expanded by folding the material along fold lines 36 and 37. The fold lines 36 extend between the ends 33 of the lances 31 and the fold lines 37 extend between the ends 34 of the lances 32. The folding of the material causes the material along the fold lines to be bent through 180 degrees, and after the folding or bending operation is completed, the strip of material 30 assumes the condition illustrated in FIG. 3. It should be noted that in such condition, the strip of metal 30 has been laterally expanded a considerable amount. After the expansion of the metal by the folding operations, the portions of the metal between adjacent parts of the lances 31 and 32 provide an array

of legs 38 and lateral projections 39 and 41. The projections 39 are formed by the portions of the material between the lances 31 and the projections 41 are formed by the material between the lances 32. The legs 38 extend between adjacent folds 36 and 37, and provide an angulated bridging connection between the two sides 42 and 43 of the expanded metal. When the lances are curved as illustrated, the projections 39 and 41 have concave curved edges and the legs 38 have convex curved edges which match the curved edges of the projections. DZ

After expansion, the folds 36 are aligned with each other and parallel to the line of folds 37. During the expansion operation, the material forming the sheet 30 is not deformed to any material extent except at the folds 36 and 37. Therefore, the expansion of the metal does not create stresses, tears, or other weakening conditions so long as the metal thickness and properties are selected so that the metal can be bent through 180 degrees without appreciable weakening at the fold line.

In the embodiment of FIGS. 1 through 4, the flanges 11 and 12 and the stiffening ribs 14 and 16 are formed subsequent to the expanding operation. However, it is within the broader scope of this invention to form the bends to produce such flanges and tabs prior to the lancing and expanding of the metal.

As best illustrated in FIG. 5, the folds at 36 and 37 are tightly formed so that the portion of the material 46 and 47 originally existing between the ends of the lances of one array and the adjacent portions of the lances of the other array extends back along the associated projecting portions 39 and 41 in substantially full contact therewith. Therefore, the overlapping portions provide two layers in engagement with each other.

In fact, it is preferred to overbend each of the folds to ensure good contact along such overlapping portions.

When the folds are tightly formed in this way, the plane of the legs 38 is substantially coplanar with the plane of the unexpanded portions 42 and 43 on either side of the expanded portion of metal. In the drawings, the thickness of the metal is exaggerated somewhat for purposes of illustration, but a drywall stud would normally be formed of metal having a thickness in the order of 0.022 inch, so the legs 38 and the remaining portions of the web are virtually coplanar and the expanded metal web is capable of resisting collapse even when subjected to substantial compressive forces. Further, such a web is also able to withstand substantial bending stress without permanent deformation and provides sufficient stability to absorb the forces applied to the flanges during the operation of driving the screws 24.

Referring to FIG. 5, if a screw is driven into the flange 11 to the left of the plane of the web 13, it produces in the web a bending moment tending to open the fold 37. Therefore, the length of the folds should be selected to provide sufficient strength to prevent appreciable opening of the fold under the bending stresses expected to be encountered. On the other hand, in such embodiment such bending stresses applied to the flanges 12 do not tend to open the fold 36 because the stresses are in a direction tending to further close the fold, which is resisted by the portion 47.

Bending stresses, however, resulting from inward forces applied to either flange do tend to cause bending of the legs 38. With the preferred form illustrated in which the legs are curved, the legs 38 have a maximum width along the centerline of the web which is the point

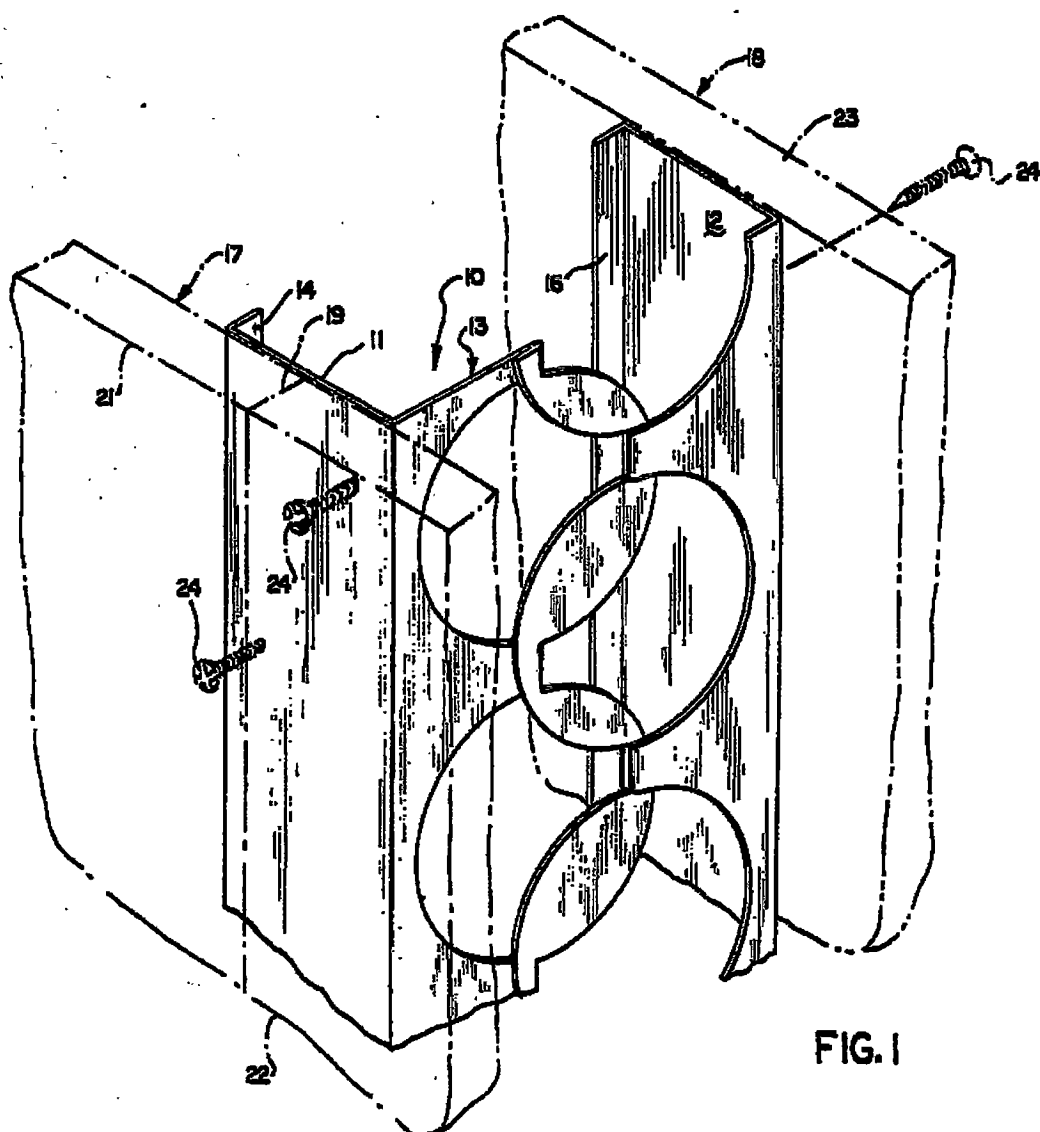


FIG. 1

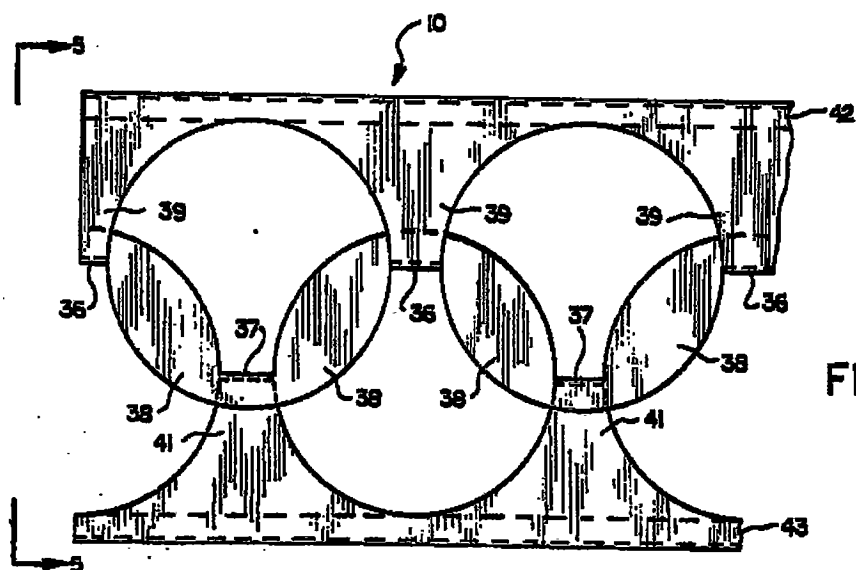


FIG. 4

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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& CO. KG [DE/DE]; Viktoriastr. 58, 76571 Gaggenau
(DB).

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(72) Erfinder; und

(22) Internationales Anmeldedatum:
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(75) Erfinder/Anmelder (nur für US): KRETTENAUER,
Killian [DE/DE]; Wieseweg 19, 76571 Gaggenau (DB).

(25) Einreichungssprache: Deutsch

(74) Anwalt: MANITZ, FINSTERWALD & PARTNER
GBR; Postfach 31 02 20, 80102 München (DE).

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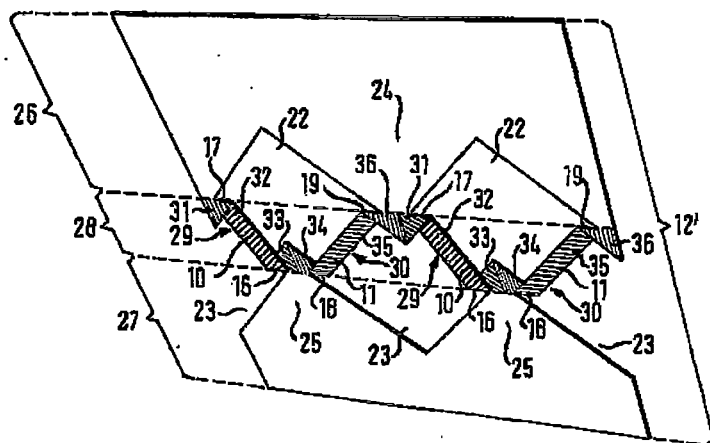
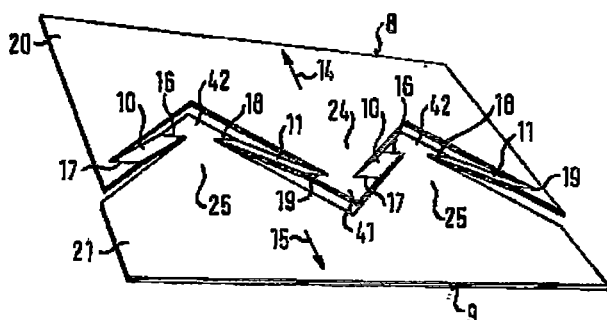
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KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
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[Fortsetzung auf der nächsten Seite]

(54) Title: PLANAR METAL ELEMENT AND PROFILE ELEMENT

(54) Bezeichnung: FLÄCHIGES METALLELEMENT UND PROFILELEMENT



(57) Abstract: A planar metal element with a surface running from one first outer edge (8) to a second outer edge (9), lying opposite the first outer edge is disclosed. The region of the metal element, adjacent to the first outer edge (8), forms a first boundary region (26) and the region of the metal element, adjacent to the second outer edge, forms a second boundary region (27). Both boundary regions (26, 27) are connected to each other by means of a mid region (28), lying between the above, whereby at least one fully enclosed hole (23, 24) is embodied in at least one of the boundary regions, the enclosure of which is formed partly from said boundary region (26, 27) and the other part is formed by the mid region (28). The mid region (28) comprises at least two sections (29, 30), each comprising two outer partial sections (31, 33, 34, 36) and a mid partial section (32, 35), lying between the above. The outer partial sections (31, 33, 34, 36) are folded against the mid partial section (32, 35) to generate the hole (22, 23). The sections (29, 30) form a part of the enclosure of the hole (22, 23) and the mid region (28), including sections (29, 30), is embodied as one piece with both boundary regions (26, 27) of the metal element.

[Fortsetzung auf der nächsten Seite]

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(54) **PLANAR METAL ELEMENT AND PROFILE ELEMENT**

(52) **U.S. CL** 428/597; 428/596

(76) **Inventor: Killian Krettenauer, Gaggenau (DE)**

(57) **ABSTRACT**

Correspondence Address:
FULBRIGHT AND JAWORSKI LLP
555 S. FLOWER STREET, 41ST FLOOR
LOS ANGELES, CA 90071 (US)

An areal metal element is described having a surface which extends from a first outside edge to a second outside edge lying opposite the first out-side edge. The region of the metal element adjoining the first outside edge forms a first edge region and the region of the metal element adjoining the second outside edge forms a second side region. Both side regions are connected to one another by a central region lying therebetween, with at least one completely bordered aperture being formed at least in one of the side regions, with its border being formed in one part by this side region and in another part by the central region. The central region includes at least two sections which each consist of two outwardly disposed part sections and a central part section lying therebetween. The outwardly disposed part sections are folded over with respect to the central section to produce the aperture. The sections form part of the border of the aperture and the central region including the sections is made in one piece with the two side regions of the metal element.

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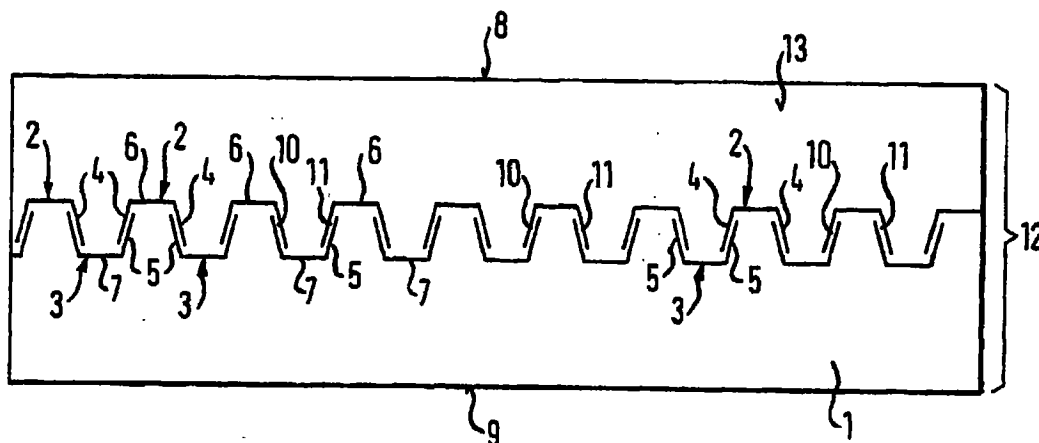
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PLANAR METAL ELEMENT AND PROFILE ELEMENT

[0001] The present relation relates to an areal metal element having a surface which extends from a first outside edge to a second outside edge lying opposite the first outside edge, with the region of the metal element adjoining the first outside edge forming a first side region and the region of the metal element adjoining the second outer edge forming a second side region, both said side regions being connected to one another by a central region lying between them, and with at least one completely bordered aperture being formed in at least one of the side regions, with its border being formed in one part by said side region and in another part by the central region. The invention is furthermore directed to a section element which is produced from such an areal metal element.

[0002] Areal metal elements of the kind initially named are used, for example, in the production of sections. Such sections can, for example, be stand sections such as are in particular used in interior work for the fastening of plate-like elements, or also corner sections which are used for the protection of corners, usually under plaster. It is in particular necessary for such plaster sections that said sections have material apertures so that the plaster can pass through the sections and so that a fixing of the sections is thus ensured.

[0003] As a rule, such apertures are produced by punching procedures such that the parts punched out form waste. This is disadvantageous, on the one hand, since these parts either have to be disposed of or made available for recycling. On the other hand, a substantial disadvantage lies in the fact that the costs in the production of a corresponding section are determined to a predominant degree by the material costs. A punching out of part surfaces is thus uneconomic, in particular when the punched out part surfaces have to be disposed of as waste.

[0004] To avoid this disadvantage, it is already known to produce bored sections from expanded metal. In the use of expanded metal, slots are cut into the metal sheet used for the production of the sections such that the metal sheet is subsequently pulled apart at two opposite sides, with the slots expanding to form the desired apertures. The material lying between the apertures is stretched or expanded in this process, whereby the desired deformation and, associated therewith, a widening of the material takes place. However, strains arise in the material by the expanding of the material which can result in an unwanted weakening. The bending stiffness of expanded metal is also reduced so that expanded metal cannot be used in many areas. Finally, the widenings of the material achieved with the expanded metal are often not sufficient.

[0005] It is an object of the present invention to develop an areal metal element of the kind initially named such that the apertures are formed without material loss, with at the same time substantially no strains being present within the material. Furthermore, the metal element should have a high stiffness and a large widening of the material or extension of the area should be possible with respect to the starting material.

[0006] Starting from a metal element of the kind initially named, this object is satisfied in accordance with the invention in that the central region includes at least two sections

which each consist of two outwardly disposed part sections and one center part section lying between them, in that the outwardly disposed part sections are folded over with respect to the central part section to produce the aperture, in that the sections form part of the border of the aperture, and in that the central region including the sections is formed in one piece with the two side regions of the metal element.

[0007] In accordance with the invention, the apertures are thus not produced by an expansion procedure in the areal metal element, but by a folding over of part sections such that a stretching or an expansion within the metal element, such as is present in expanded metal, is avoided. The folded over part sections are arranged such that an unfolding of the two outer side regions of the metal element apart from one another takes place during the workstep, whereby the desired widening of the material or expansion is achieved. At the same time, it is ensured by the folding over and by the formation in one piece of the metal element that the apertures in the metal element can be produced in a one-piece production process and the desired stiffness and stability are ensured.

[0008] In accordance with an advantageous embodiment of the invention, the outwardly disposed part sections extend in opposite senses to one another, that is are folded over in directions opposite to one another. One of the outwardly disposed part sections is in particular folded over toward the upper side of the central part section and the other outwardly disposed part section is folded over toward the lower side of the central part section. The part sections can be folded over either facing one another or facing away from one another.

[0009] It is generally also possible for the outwardly disposed part sections to be folded in the same sense with respect to one another, that is facing in the same direction. Both outwardly disposed part sections are in particular folded over toward the same side in this process, that is either both are folded over toward the upper side or both are folded over toward the lower side of the central part section.

[0010] In accordance with a further advantageous embodiment of the invention, a plurality of apertures are formed at least in one of the side regions. This is in particular sensible when the areal metal element has an elongated design extending in the direction of the outer edges, since a corresponding widening of the metal element over its total length is only possible by the apertures. A plurality of apertures are advantageously formed in each of the side regions. These apertures are preferably spread alternately in both side regions, with preferably the folded over, outwardly disposed part sections of a respective section simultaneously being associated with a respective aperture of the first side region and with an subsequent aperture of the second side region.

[0011] In accordance with a further advantageous embodiment of the invention, additional apertures are formed in the central region. The apertures formed in the central region are advantageously formed in correspondence with the apertures formed in the side regions. It is thus possible to achieve an additional widening of the metal element in that a plurality of sections folded over in accordance with the invention are provided which lie in series between the outside edges.

[0012] A section is advantageously formed as a web with side edges extending parallel to one another. The side edges

of the section can, however, generally also extend obliquely with respect to one another or, for example, also be curved, as long as the turning over of the part sections in accordance with the invention is not prevented thereby. Surfaces deviating from the web shape, for example laterally projecting surfaces, can in particular be provided at the ends of the sections.

[0013] In accordance with a further preferred embodiment of the invention, the side edges and the webs extend parallel to one another or obliquely to one another. The geometry is also only restricted in this process in that a folding over of the outwardly disposed part sections, and thus turning over of the two side regions apart from one another, is not hindered.

[0014] It is achieved by the invention that the spacing between the first and the second outside edges with folded over part sections is substantially larger than with part sections not folded over. The desired material widening is achieved in this manner. It is in particular possible with the invention for the spacing with folded over part sections to be approximately between 1.3 and 4 times as large, in particular approximately between 2 and 3 times as large as with part sections not folded over. A much larger expansion is thus possible with metal elements formed in accordance with the invention by the folding in accordance with the invention than can be achieved, for example, when expanded metal is used.

[0015] The apertures advantageously repeat at regular intervals, with this applying both to the apertures formed in the side regions and to any apertures formed in the central region. The apertures can generally also repeat at irregular intervals.

[0016] In accordance with a further advantageous embodiment of the invention, the side regions have a substantially planar surface, with the exception of the apertures. The surface of the metal elements is also advantageously planar, with the exception of the apertures. This can be achieved, for example, in that the material thickenings present due to the folding over are rolled flat. A strain hardening thereby additionally occurs at the bending lines and at the folded over part sections rolled thin such that, despite the folding of the material, the stiffness of the folded over sections corresponds at least to the stiffness of the starting material. This is in particular important when the sections formed as webs, for example, are made relatively thin, since in this case a high stiffness of the total metal element is ensured by the strain hardening despite these thin connection positions between the two side regions.

[0017] In accordance with a further advantageous embodiment of the invention, the folded over, outwardly disposed part sections include an angle in each case with the central part section of approximately 110° to 0° , preferably from approximately 90° to 0° , advantageously from approximately 45° to 0° , in particular from 10° to 0° . To produce an areal, widened metal element, the outwardly disposed part sections are completely folded over such that they include an angle of approximately 0° with the central part section. It is, however, generally also possible for the folding process not to be carried out up to the complete turning over such that three-dimensional structures can be produced. They can be used, for example, in the production of composite materials, of filters or the like.

[0018] In accordance with a further advantageous embodiment of the invention, each of the folded over, outwardly disposed part sections, which is directly connected to a side region, merges continuously, in particular in a planar manner, into the side region connected to it. A smooth or planar surface of the metal element is thereby achieved in this region without edges, bends or the like.

[0019] In accordance with a further preferred embodiment of the invention, a respective further metal section adjoins the first and/or the second out-side edges and forms an angular section together with the material extending between the first and the second outside edges. The angular section can in particular be L-shaped, V-shaped, U-shaped, C-shaped or Z-shaped. The areal metal element can easily be used for the forming of a section by this design. The further metal section or metal sections can either have an unbroken surface or, if desired, likewise be interspersed with apertures in accordance with the invention. If, for example, a plaster section should be produced, the angular section is advantageously made in L shape, with both limbs of the section preferably being provided with apertures in accordance with the invention. If the angular section is, in contrast, a holder section, for example, a C-shaped, U-shaped, T-shaped, I-shaped or Z-shaped design is advantageous, with the apertures only being present in the central base part, but not in the outwardly disposed limbs. If required, the apertures can also be formed directly in the bending lines of the angular sections or only in one or more limbs.

[0020] The metal element in accordance with the invention can generally be used everywhere where areal metal sections are used, e.g. in all types of open or closed metal sections such as also tubular sections.

[0021] The further metal section is, or the further metal sections are, preferably made in one piece with the remaining part of the metal element in order to maintain the one-step manufacturing process in this manner.

[0022] In accordance with a further preferred embodiment of the invention, in addition to the first and second side regions, a third and a fourth side region are present which are opposite one another and which each extend transversely, in particular perpendicularly, to the first or second regions. The design of the surface of the material strip corresponds in a direction from the third to the fourth side region substantially to the design of the surface in a direction from the first to the second side region. A material widening is thus not only possible in one direction in this manner, in particular transversely to the longitudinal extent of the metal element, but, for example, in two directions lying perpendicular to one another, for example a direction longitudinally to the longitudinal extent of the metal element and a direction transversely to the longitudinal direction of the metal element. In this embodiment, a two-dimensional expansion and material widening is thus achieved.

[0023] The metal element in accordance with the direction can be used in a variety of manners. For example, the metal element can be used as a section element, in particular as a corner section or as a holder section, as a protective grid, as a fence section, as a filter mat, as a soundproofing element, as a plant climbing frame, as a step element, as a reinforcement mat, as an insert in composite materials, as a cable duct, as an aperture band, as a fitting, acoustic or shadowing element or as a decorative section. It is possible in each case

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for the corresponding elements to be formed completely by the metal element in accordance with the invention or for, as already described, further metal sections to adjoin the metal element containing the apertures.

[0024] The invention can generally be used in all areas in which areal materials are perforated, bored or punched in order, for example to achieve a permeability or part permeability or directed reflection for light, sound or fluids. It is achieved with the invention that, differently for example to a perforation, no material waste is created in the production of the apertures and thus costs can be reduced. Further areas of use can be: use in armored glass, sandwich floors, packaging/insulating material, ceiling suspenders, cable carrying systems, metal sheets of catalytic converters, line guiding systems, punched plates, punched strips, installation bands, installation brackets, shelf supports, flat angle connecting strips, roller shutter sections, post supports, section bands, rail systems, slotted bands, strut connectors, support rails or mesh manufacture.

[0025] Typical thicknesses of the material strips used in this process lie between approximately 0.3 mm up to 2 mm, in particular between approximately 0.4 mm and 0.8 mm. Aluminum, sheet zinc, stainless steel or galvanized sheet steel can be used as the material, for example. However, the invention is not limited to these thickness values or materials.

[0026] Further advantageous embodiments are recited in the dependent claims.

[0027] The invention will be described in more detail in the following with reference to embodiments and to the Figures; there are shown in these:

[0028] FIG. 1 a cutting pattern with which a metal element in accordance with the invention can be manufactured;

[0029] FIGS. 2-4 three different states during the manufacture of a metal element formed in accordance with the invention in accordance with the cutting pattern in accordance with FIG. 1;

[0030] FIG. 5 a further cutting pattern for the manufacture of a metal element formed in accordance with the invention;

[0031] FIGS. 6-8 three method steps for the manufacture of a metal element formed in accordance with the invention in accordance with a cutting pattern in accordance with FIG. 5;

[0032] FIG. 9 a further cutting pattern;

[0033] FIGS. 10-12 three method steps for the manufacture of a metal element formed in accordance with the invention in accordance with the cutting pattern in accordance with FIG. 9;

[0034] FIGS. 13-15 three alternative method steps in the manufacture of the metal element formed in accordance with the invention in accordance with the cutting pattern in accordance with FIG. 9;

[0035] FIG. 16 a further cutting pattern;

[0036] FIG. 17 a metal element formed in accordance with the invention which was manufactured in accordance with the cutting pattern in accordance with FIG. 16;

[0037] FIG. 18 a further cutting pattern;

[0038] FIGS. 19-21 three method steps for the manufacture of a metal element formed in accordance with the invention in accordance with the cutting pattern in accordance with FIG. 18;

[0039] FIG. 22 further variants of different cutting patterns;

[0040] FIG. 23 a schematic representation of a corner section in accordance with the invention; and

[0041] FIG. 24 a schematic representation of a holder section formed in accordance with the invention.

[0042] FIG. 1 shows an elongated material strip 1, in particular a metal sheet into which slots 2, 3 extending in meander shape are cut. The slots 2, 3 can be introduced into the material strip 1, for example, by a punching method or by a cutting method (e.g. a rotary cutting method, a laser cutting method) or by another suitable method.

[0043] The slots 2, 3 are each made in U shape, with the two limbs 4, 5 running apart from one another toward the open side of the U.

[0044] The limbs 4, and also the limbs 5, are each connected to one another by linear base cuts 6, 7 which are each arranged parallel to one another.

[0045] The U-shaped slots 2 each lie at the same height, following one another periodically in series along the longitudinal axis of the material strip 1. The U-shaped slots 3 along the longitudinal axis of the material strip 1 lie at equal intervals following one another in series, with the open sides of the U-shaped slots 2 and 3, however, facing toward the respectively other outside edge 8, 9 of the material strip 1. The U-shaped slots 2, 3 are arranged engaging into one another such that the limbs 4, 5 respectively overlap and webs 10, 11 are formed between the limbs 4, 5.

[0046] The material strip 1 has a surface 13 with a width 12 which extends from the outside edge 8 to the outside edge 9.

[0047] In accordance with FIGS. 2 to 4, a folding process is used for the manufacture of a metal element formed in accordance with the invention using the cutting pattern in accordance with FIG. 1 as a base. For this purpose, the side sections of the material strip 1 are moved apart from one another in opposite directions in accordance with arrows 14, 15 such that the webs 10, 11 are each kinked at two kink lines 16, 17 or 18, 19. On a further pulling apart of the material strip 1 along the arrows 14, 15, the two halves 20, 21 of the material strip 1 connected to one another by the webs 10, 11 move apart from one another until they arrive at the position shown in FIG. 4 after a complete pivoting, where they again substantially lie in the same plane.

[0048] After the complete pivoting and the resulting pulling apart from one another of the halves 20, 21 of the material strip 1, apertures 22, 23 are formed in the latter, as can be recognized from FIG. 4. The material filling the apertures 22, 23 prior to the pulling apart forms corresponding lugs 24, 25 which are each connected to one another via two of the webs 10, 11 and are displaced toward one another with respect to the starting state by twice the web length in the direction of pulling apart. The shape of the lugs 24, 25 is complementary to the shape of the apertures 22, 23 with the exception of the web regions.

[0049] The width 12 of the material strip 1 has enlarged by twice the web length to the width 12' by the expansion process. Substantially no stretching strains or bending strains occur in the material of the material strip 1 during the expansion procedure or the folding procedure. A bending of the material only takes place directly in the kink lines 16, 17, 18, 19 by the folding over. The material expansion with respect to the surface enlargement is negligible in this process.

[0050] In the end position shown in FIG. 4, the material strip 1 has a first side region 26 adjoining the outside edge 8, a second side region 27 adjoining the second outside edge 9 as well as a central region 28 which lies between the two side regions 26, 27 and by which the two side regions 26, 27 are connected to one another.

[0051] The central region 28 includes four sections 29, 30 shown by broken lines, with each of these sections 29, 30 consisting of three part sections 31, 32, 33 or 34, 35, 36 respectively. For clarification, the respective outwardly disposed part sections 31, 33 of the section 29 shown in FIG. 4 are hatched in opposite directions obliquely to the central part section 32 lying therebetween. In a similar manner, the outwardly disposed part sections 34 and 36 of the sections 30 are transversely hatched, while the central section 35 lying therebetween is longitudinally hatched with respect to the longitudinal direction of the material strip 1.

[0052] As can be recognized from FIG. 4, the respective outwardly disposed part sections 31, 33; 34, 36 are folded over completely in an opposite sense with respect to the central part sections 32, 35 such that the outwardly disposed part sections 31, 34 contact the upper side of the central part sections 32, 35 and the outwardly disposed part sections 33, 36 contact the lower side of the central part sections 32, 35.

[0053] It is pointed out in this process that the expression "outwardly disposed" part sections does not necessarily mean that these part sections lie closer to one of the outside edges 8, 9 than the central part sections, but that this expression describes the division of the sections 29, 30 into three part sections, with the "outwardly disposed" part sections in each case being the part sections which are connected to one another by a joint central part section lying between them.

[0054] To obtain a surface 13 which is as smooth as possible, the material strip 1 can be guided through a roll apparatus after termination of the folding process. The material, which has three layers in the central region 28, is pressed together by a correspondingly high pressure, with a strain hardening of the material arising at the same time. A largely planar surface 13 is thus produced by the roll procedure, on the one hand, and an increased stability of the material strip 1 is also achieved in the region of the kink lines 16, 17, 18, 19 as well as of the relatively thin webs 10, 11, which form the central part sections 32, 35, on the other hand.

[0055] The embodiment shown in FIGS. 5 to 8 substantially corresponds to the embodiment described with respect to FIGS. 1 to 4 so that the same reference numerals are used for the same elements as in FIGS. 1 to 4.

[0056] The embodiment in accordance with FIGS. 5 to 8 differs from the embodiment in accordance with FIGS. 1 to 4 only in that two further obliquely extending slots 37, 38 are

provided in each case between the U-shaped slots 2, 3. Two webs 10, 10' or 11, 11' respectively arise in each case which lay in series parallel to the expansion direction in accordance with the arrows 14, 15 due to these further slots 37, 38.

[0057] The folding procedure takes place identically to the folding procedure described with respect to FIGS. 2 to 4. It is advantageous in the embodiment in accordance with FIGS. 5 to 8 that an even higher stability of the expanded material strip 1 is given by the additional webs 10', 11'.

[0058] It can furthermore be recognized in FIG. 8 that, on the basis of double the number of webs 10, 10', 11, 11', the central region 28 also has double the number of sections 29, 30 as well as double the number of part sections 31 to 36.

[0059] FIG. 9 shows an embodiment in which V-shaped slots 37, 38 are cut into the material strip 1 instead of the U-shaped slots 2, 3. Similar to the U-shaped slots 2, 3, the V-shaped slots 37, 38 are also each arranged lying next to one another in the longitudinal direction of the material strip 1 and engaging into one another in an offset manner. The V-shaped slots 37, 38 have limbs 39, 40 which overlap one another such that respective webs 10, 11 are again formed between the limbs 39, 40.

[0060] The material strip 1 is moved apart in accordance with FIGS. 10 to 12, in an identical manner as described in FIGS. 2 to 4, along two arrows 14, 15 such that the width 12 of the material strip 1 is expanded to an enlarged width 12' after the end of the folding procedure.

[0061] In the folding procedure shown in FIGS. 10 to 12, the webs 10, 11 are folded over as in FIGS. 2 to 4 along the kink lines 16, 17, 18, 19 such that the lugs 24, 25 have triangular tips 41, 42 due to the V-shaped design of the slots 37, 38. Said tips lie in a plane with the lugs 24, 25 in the folding over procedure shown in FIGS. 10 to 12 and respectively form the outwardly disposed part sections 31, 33; 34, 36.

[0062] In contrast to this, in the folding procedure shown in FIGS. 13 to 15, the triangular tips 41, 42 are turned over together with the webs 10, 11 along kink lines 43, 44. With the exception of this modified course of the kink lines 43, 44, the folding procedure shown in FIGS. 13 to 15 is identical to the folding procedure shown in FIGS. 10 to 12.

[0063] The resulting width 12' of the material strip 1 is identical in both cases; only the number of kink lines 43, 44 is reduced in the folding described with respect to FIGS. 13 to 15.

[0064] As already described with respect to the embodiment in accordance with FIGS. 1 to 4, the material strip 1 can also be supplied in the embodiments in accordance with FIGS. 5 to 15, in each case after the complete folding over, to a smoothing apparatus with which the multi-layer material sections are pressed together.

[0065] Whereas both in the embodiments in accordance with FIGS. 1 to 4, FIGS. 5 to 8, FIGS. 9 to 12 and also FIGS. 13 to 15, the kink lines have in each case been selected in an identical manner on both sides of the central region 28, it is generally also possible, for example, to select the kink lines on one side of the central region 28 in accordance with the embodiment in accordance with FIGS. 10 to 12 and on the other side of the central region 28 in accordance with the embodiment in accordance with FIGS. 13 to 15. The same

also applies to embodiments which do not have V-shaped slots 37, 38, but, for example, U-shaped slots or other slot shapes. In this case, the folded over part sections are thus not folded in opposite senses, but in the same sense.

[0066] With respect to the embodiments in accordance with FIGS. 9 to 15, this would mean that on one side of the central region 28, the triangular tips 41 are, as shown in FIG. 12, folded over with respect to the webs 10, 11, whereas the opposite triangular tips 42 form, as shown in FIG. 15, continuous extensions of the webs 10, 11.

[0067] In the embodiments in which the bending lines of two adjoining outwardly disposed part sections are separated from one another (see e.g. FIGS. 1-8, 10-12, 19-21), it is also possible for the two mutually adjoining outwardly disposed part sections to be turned over in opposite directions with respect to their respective central part sections. In the embodiment in accordance with FIG. 4, this would e.g. mean that the section 29 is folded as shown, in the section 30, in contrast, the outwardly disposed part section 34 does not lie above the central part section 35, as shown in FIG. 4, but beneath it. The outwardly disposed part section 36 would accordingly not lie beneath the central part section 35, but above it. These different folding directions can occur regularly, for example alternately, or irregularly. The bending stiffness of the metal element can be improved by these sections folded with respect to one another.

[0068] The bending stiffness can also be increased in that sequential sections 29, 30 are not only arranged along a straight line over the length of the metal element, in particular in the longitudinal direction of the metal element, but in that at least some sections 29, 30 are arranged laterally offset to one another. While in the embodiment in accordance with FIG. 4, all sections 29, 30 follow one another in a straight line, in the embodiment in accordance with FIG. 8 the sections 29, 30 respectively lying more closely to the outside edge 8 are arranged laterally offset with respect to the sections 29, 30 lying more closely to the outside edge 9 such that the embodiment in accordance with FIG. 8 has a larger bending stiffness than that in accordance with FIG. 4. It would, for example, also be possible in the embodiment in accordance with FIG. 4 to offset the sections 29 laterally in each case with respect to the sections 30 or to offset in each case a pair of sections 29, 30 laterally with respect to the next pair of sections 29, 30 in order to achieve an increased bending stiffness in this manner.

[0069] FIG. 16 shows the cutting pattern in accordance with FIG. 9, with instead of a single double row of V-shaped slots 37, 38, a plurality of such V-shaped slots engaging into one another being provided.

[0070] In such a row arrangement of V-shaped slots 37, 38, ultimately the structure in accordance with the invention shown in FIG. 17 results after the expansion of the material strip, with only a design with two double rows of V-shaped slots 37, 38 next to one another being shown for reasons of simplification.

[0071] In a similar manner as described with respect to FIGS. 5 to 8, a plurality of webs lying in series 10, 10', 10, 10" or 11, 11', 11, 11", in this case namely three webs lying in series, result in this process in the expansion direction. It is worthy of mention that in this case the respectively central web 10' or 11' forms a folded over, outwardly disposed part

section for the webs 10 and 10" and 11 and 11" respectively forming a central part section.

[0072] FIG. 18 shows a cutting pattern which permits an expansion of the material strip 1 both along the arrows 14, 15 and at the same time along arrows 45, 46. A material expansion is thus possible with this cutting pattern not only along one axis, but along two axes standing perpendicular to one another.

[0073] In this case, in addition to webs 10, 10', 11, 11', which extend lying in series between the outside edges 8, 9, webs 47, 47', 48, 48' arranged perpendicular to these webs are furthermore formed, as can be seen from FIGS. 19 to 21. These webs are formed in accordance with the cutting pattern in accordance with FIG. 18 by the overlapping arrangements of slots 49, 50 arranged in a cross-shaped manner.

[0074] Further possible cutting patterns are shown in FIG. 22. In these cutting patterns, as in the already shown cutting patterns, all edges extending toward a tip can, for example, also be replaced by corresponding rounded designs. Furthermore, a multiple staggering such as is shown in FIG. 5, in contrast to in FIG. 1, is also possible with the cutting patterns in accordance with FIG. 22. A parallel arrangement of a plurality of basic patterns parallel to one another as, for example, FIG. 16 shows in comparison to FIG. 9, is possible with the cutting pattern in accordance with FIG. 22.

[0075] It is uniform with all cutting patterns that the kink lines created on the folding procedure are always aligned perpendicular to the expansion direction.

[0076] Finally, in FIGS. 23 and 24, a further two application examples of the invention are shown.

[0077] FIG. 23 shows schematically a corner section 51 such as is used as a plaster section. The corner section 51 in this process is formed as an L-shaped angular section, with both limbs of the angular corner section 51 being provided with apertures 22, 23 in accordance with the invention. It is ensured by the apertures 22, 23 that the plaster used for the plastering of the corner section 51 can pass through the corner section 51 and a secure fastening of the corner section 51 is thus ensured.

[0078] By the forming of the corner section 51 in accordance with the invention by means of a metal element expanded in accordance with the invention, at the same time the material requirement for the production of the corner section is reduced and the required stiffness of the corner section is ensured.

[0079] FIG. 24 shows two holder sections 52 which are each formed as C-shaped angular sections. While the two limbs 53, 54, to which a plate 55 is fastened, for example, by screws 56, are formed in the usual manner as solid material, the two base sections 57 of the holder sections 52 are manufactured as metal elements formed in accordance with the invention and are provided with the corresponding apertures 22, 23. It is ensured in this manner that the material consumption for the manufacture of the holder sections 53 is substantially reduced with respect to conventional methods.

REFERENCE NUMERAL LIST

- [0080] 1 material strip
[0081] 2 slots

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