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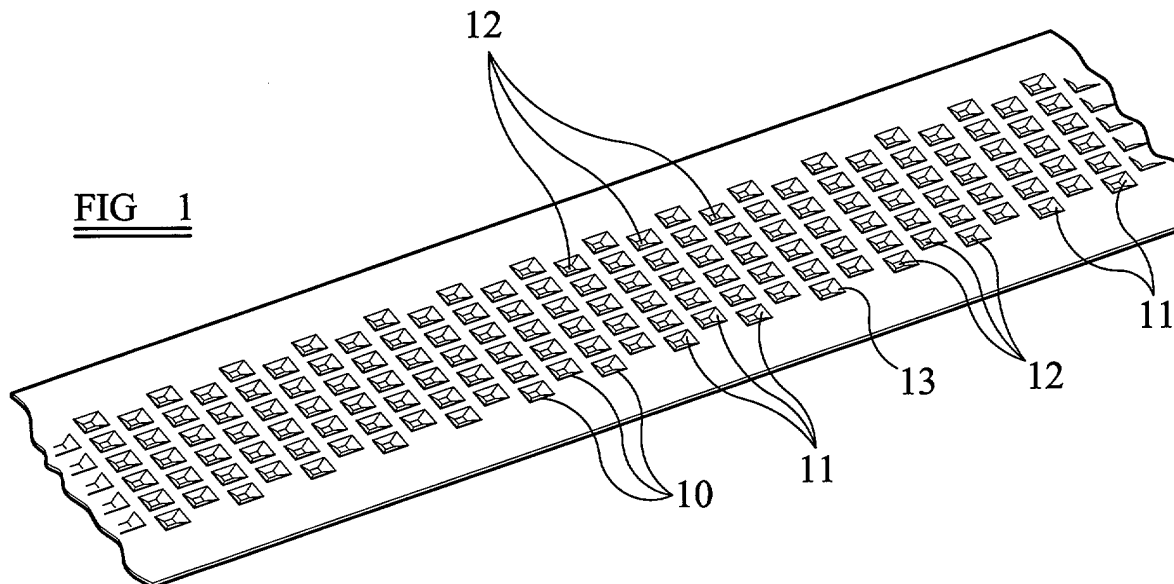
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(54) **Sheet or strip metal**

(57) A strip material has a plurality of rectilinear columns (10) of spaced deformations, the deformations in one column (10) being offset/staggered relative to the deformations in the or each column (10) next thereto, such that any straight line on a surface of the material

perpendicular to the columns (10) must pass through a deformation. Also disclosed is a method of manufacturing such strip material and apparatus for carrying out the method. The strip material has increased resistance to bending and is suitable for use to form studs and/or tracks in partitioning systems.



## Description

**[0001]** This invention relates to sheet or strip material, hereinafter referred to as strip material, and is particularly concerned with metal strip material, such as a mild steel strip, and the processing thereof.

**[0002]** A main intended use of metal strip of the invention is in a partitioning systems, such as those comprising a series of vertical steel elements (studs with a lipped channel shaped cross-sectional profile) and top and bottom channels for these to be received in (tracks with a channel shaped cross-sectional profile). Typically the studs will be fixed top and bottom to the tracks using self tapping screws. Plasterboard is attached to either side of the resulting framework using a series of screws along the length of the studs and tracks. Deformations are required in the strip material due to the need for plasterboard screws to locate firmly into the metal of the framework. The inclusion of such deformations provides a challenge to configure the stiffness of the strip metal material in the most effective manner.

**[0003]** With the prior art strip material, which is also for use as a stud/track profile, there is an attempt to increase stiffness in all directions. This results in compromising the ultimate strength achievable in any one specific direction. It is well known, for example from WO94/12294, WO96/41691, WO97/23694 and WO00/71277, to introduce deformations into plain flat strip material, normally with a view to increasing its strength/stiffness as compared to that of the plain material. However in general these prior art specifications have not been principally concerned with the strip's longitudinal pattern stiffness.

**[0004]** An object of the invention is to provide strip material having improved, preferably optimised, bending strength/stiffness about a longitudinal axis.

**[0005]** According to a first aspect of the invention there is provided strip material having a plurality of rectilinear columns of spaced deformations, the deformations in one column being offset/staggered relative to the deformations in the or each column next thereto, such that any straight line on a surface of the material perpendicular to the columns must pass through a deformation.

**[0006]** Preferably the strip material is formed flat between each column and the offset column next thereto.

**[0007]** Alternatively the strip material is formed with parallel corrugations, each column of deformations being at one side of the material in a crest of the corrugations. The troughs between said crests do not contain such deformations.

**[0008]** According to a second aspect of the invention a method of manufacturing strip material comprises passing undeformed or substantially undeformed strip material through the nip of two rolls, one of which is of male toothed form and the other of which is either of corresponding female form or is of corresponding axially splined form, the male teeth being in a plurality of rec-

tangular columns, the teeth in one column being offset/staggered relative to those in the or each column next thereto.

**[0009]** With the male and female forms, the processed strip material is formed with an offset flat pattern, whilst with the male and splined forms, the processed strip material is formed with an offset ribbed pattern. In both cases however the longitudinal strength/stiffness, i.e. its resistance to bending is improved.

**[0010]** The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of strip material according to a first embodiment of one aspect of the invention,

Figure 2 is a perspective view of strip material according to a second embodiment of one aspect of the invention,

Figure 3 is a perspective view of a roll used in one embodiment of a method of a second aspect of the invention, and

Figures 4 and 5 are respectively rolls used with said first roll in said one embodiment and a further embodiment of said method of said second aspect of the invention.

**[0011]** Figure 1 shows a planar, elongate metal strip, preferably of galvanised mild steel, which is processed according to one aspect of the invention to produce an offset flat pattern along its length consisting of a number of equispaced parallel columns 10 of deformations. In the one side of the strip shown in Figure 1, the deformations are in the form of depressions 11, whilst the material deformed out of the plane of the strip at said one side to form the depressions, correspondingly forms equivalent projections (not shown) at the other side of the strip.

**[0012]** Whilst the exact shape of the depressions and corresponding projections can be varied as required, it can be seen that in the example illustrated each depression has a innermost central square base 12 from each of the four sides of which extends a sloping frustoconical surface 13. Accordingly at the opposite side of the strip each projection has a central square flat crest from each of the four sides of which depends an outwardly sloping frustoconical surface. As can be seen from Figure 1, one pair of opposite sides of the square base 12 and also of the square at the open end of each depression is parallel to the length of the strip material, whilst the other pair of sides is perpendicular thereto, i.e. parallel to the rectilinear columns 10 which extend regularly spaced transversely across the width of the strip.

**[0013]** Importantly, it will be noted that the deformations (projections and depressions) in one column are

offset/staggered relative to the deformations in the respective columns at opposite sides thereof. In the example illustrated the offsetting is by approximately half the distance between adjacent depressions/projections in a column. Accordingly it will be appreciated that the centre of the depression in one column will be aligned with the metal between a pair of depressions in the next column, and so on. Accordingly any straight line on either surface of the strip material which is perpendicular to the columns, i.e. which extends longitudinally of the strip material, must pass through a deformation. In the embodiment shown in Figure 1, the metal between adjacent columns of deformations is plain, undeformed, i.e. flat, as was the original sheet, and rectilinear. The opposite longitudinal edges of the strip are shown plain, undeformed, merely due to the tool used being insufficiently wide to deform the strip across its whole width, as would normally be the case.

**[0014]** Figures 3 and 4 show two co-acting rolls which are used to manufacture the strip material shown in Figure 1, these being operated in a conventional manner as is well known from the prior art referred to in the introduction hereof. Accordingly the roll 14 shown in Figure 3 has a series of spaced axial columns of spaced teeth 15, with each tooth being shaped to produce the depression 11 and corresponding projection described in relation to the columns of deformations in Figure 1. Accordingly each tooth matches the described shape of a projection at the side of the strip which is not visible in Figure 1. Similarly the roll shown in Figure 4 is the corresponding mating female roll 16 which rotates on a parallel axis to the axis of rotation of the roll 14, with two rolls being placed in the same vertical plane so that with the sheet to be processed being passed through the nip of the two rolls the teeth 14 deform the material of the strip and force it into the depression 17 of roll 16 thereby forming the depressions and projections of the Figure 1 embodiment. As can be seen from Figures 3 and 4, the column of teeth 15 are alternatively relatively offset, as are the columns of depressions 17, in order to produce the offset/staggered columns of deformations shown in Figure 1.

**[0015]** Whereas with the rolls 14 and 16 'flats' are produced between the alternate columns of deformations, replacement of the roll 16 by an axially splined roll 18 shown in Figure 5 produces the form of deformation to the strip which is shown in Figure 2. The splines 19 shown in Figure 5 are equispaced and designed to corrugate the strip whilst it is passed between the two rolls 14 and 18. Moreover since the columns of discrete, spaced depressions 17 of the rolls 16 are replaced by continuous 'grooves' of the splined roller, it will be appreciated that there are three main differences in the pattern produced in the processed strip as compared to the Figure 1 embodiment.

**[0016]** Firstly it can be seen from Figure 2 that the offset flat pattern has now been replaced by an offset ribbed pattern with the strip, in side view, being corru-

gated, with troughs and crests of the corrugations alternating at respective opposite sides of the strip. Thus firstly not only is the strip now fully corrugated along its length, but secondly each column of depressions and projections is formed along a corrugation so that there are no 'flat' spaces between the depressions/projections in each column. Moreover thirdly the metal between alternate staggered/offset columns of deformations is no longer flat but is formed of troughs (or crests) in longitudinal cross-section. In Figure 2 the corrugations are denoted by the numeral 20 whilst the projections are denoted by the numeral 21, with the corresponding depressions being on the opposite side of the strip which is not visible.

**[0017]** The 'flat' male/female strip of Figure 1 is the purest form of the invention. The 'splined roll' embodiment producing material with a ribbed appearance (Figure 2) is an alternative which also achieves the desired effect, but by using a much cheaper roll opposing the male roll.

**[0018]** The longitudinal cross-sections of the two alternative strips of Figures 1 and 2 differ, in that whereas with the Figure 1 strip the material goes 'low-high-low-high' etc. through sequential columns, the Figure 2 strip goes 'mid-high-low-high-mid-high-low' etc. through sequential columns. The offset columns of deformations ensures that the maximum amplitude of any longitudinal cross-section and therefore the maximum stiffness, is achieved.

**[0019]** As will be appreciated, the use of the male toothed roller 14 again produces the offsetting/staggering of adjacent columns of projections and depressions so that with the Figure 2 strip, any straight line on a surface of the material which is perpendicular to the lateral columns of deformations must pass through a deformation, in contrast to the prior art arrangements where since the deformations are not so staggered, straight lines can be drawn of significantly reduced cross-sectional thickness. As a consequence, with the present invention, the strength of the strip material is maximised, given that any bend about a longitudinal axis will be resisted by it having to pass through the deformations referred to. In other words it is improved over the prior art where a bend through flatter material along the length of the strip material will be facilitated and thus not provide the same level of resistance to longitudinal compression as with the present invention.

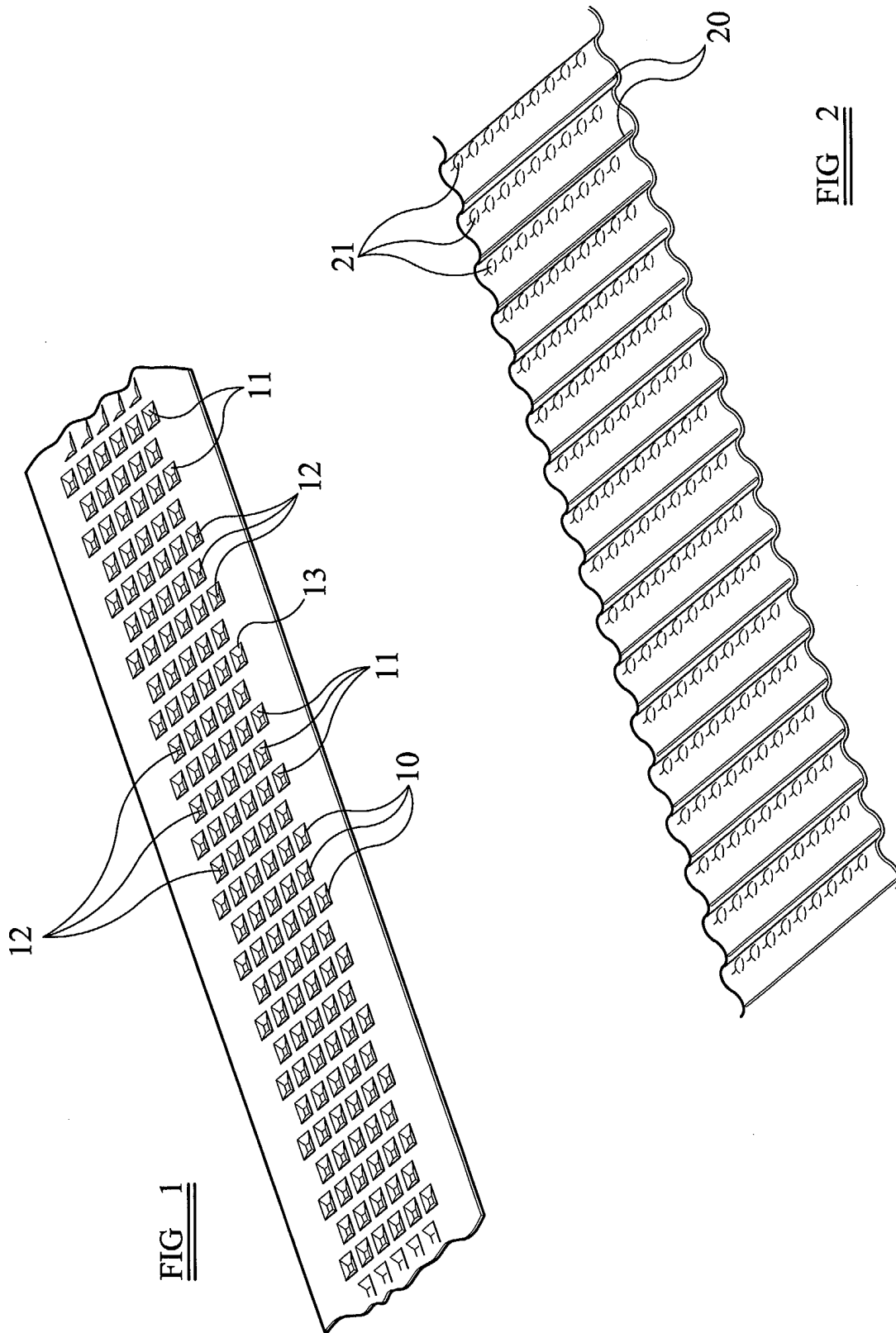
**[0020]** In contrast to the prior art, in a metal profile application, it is believed that with the present invention, the material's stiffness along the length of the stud is much less important, as the profile's cross-section provides a much higher degree of stiffness. In the direction which prevents bending of the stud and track 'legs', the material stiffness is much more important.

**[0021]** Accordingly the 'offsetting/staggering' breaks up any possible bending axis for a 'leg', and constitutes inventive concept of the present invention. In order to achieve this effectively, the offset deformations must at

least 'overlap' the deformations in an adjacent column. By definition, this results in a vertical plane through which the cross-section is linear and hence weak. However, according to the reasoning set out above, this is not important since the stiffness in that vertical plane is provided by the cross-section of the profile. The greater the 'overlap' of the deformations, the more convoluted the rectilinear path, and therefore the greater the resistance to bending.

### Claims

1. A strip material having a plurality of rectilinear columns (10) of spaced deformations, **characterised by** the deformations in one column (10) being offset/staggered relative to the deformations in the or each column (10) next thereto, such that any straight line on a surface of the material perpendicular to the columns (10) must pass through a deformation. 5
2. A strip material as claimed in Claim 1, which is formed flat between each column (10) and the offset column (10) next thereto. 15
3. A strip material as claimed in Claim 1 or Claim 2, which is formed flat between adjacent deformations in each column (10). 20
4. A strip material as claimed in Claim 1, which is formed with parallel corrugations (20), each column of deformations (21) being at one side of the material in a crest of the corrugations. 25
5. A strip material as claimed in Claim 4, wherein the troughs between said crests do not contain deformations. 30
6. A strip material as claimed in any one of Claims 1 to 5, wherein the offsetting/staggering between rows is by half or substantially half of the distance between adjacent deformations in a column (10). 35
7. A strip material as claimed in any one of Claims 1 to 6, wherein each deformation has a central square base (12) from each of the sides of which extends a sloping frustoconical surface (13). 40
8. A method of manufacturing strip material comprising passing undeformed or substantially undeformed strip material through the nip of two rolls (14: 16, 18), one of which (14) is of male toothed form and the other of which is either of corresponding female form (16) or is of corresponding axially splined form (18), the male teeth (15) being in a plurality of rectangular columns, **characterised by** the teeth in one column being offset/staggered relative to those in the or each column next thereto. 45
9. A strip material as claimed in any one of Claims 1 to 7, formed into an elongate structural profile. 50
10. A strip material as claimed in Claim 9, in the form of a stud. 55
11. A strip material as claimed in Claim 9, in the form of a track.
12. Apparatus for applying surface formations on sheet or strip material comprises a first roll (14), having male teeth (15) in a plurality of rectangular columns, the teeth in one column being offset/staggered relative to those in the or each column next thereto, and a second roll of either corresponding female form (16) or of corresponding axially splined form (18) such that, in use, the sheet or strip material passed undeformed or substantially undeformed through the nip of said first and second rolls is formed with a plurality of rectilinear columns (10) of spaced deformations which are relatively offset/staggered from one row to the next, such that any straight line on a surface of the material perpendicular to the columns (10) must pass through a deformation.



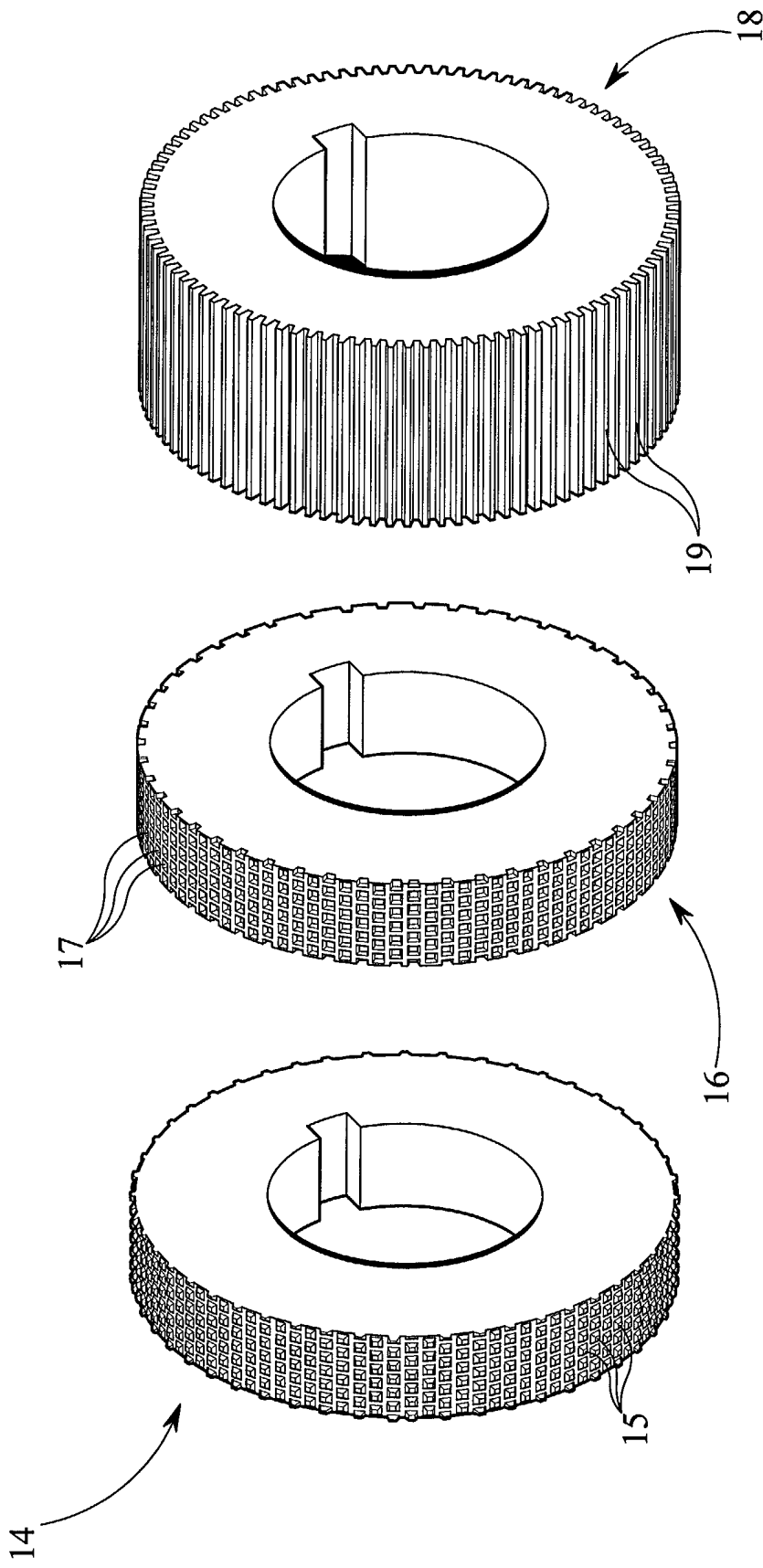


FIG 3

FIG 4

FIG 5



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Application Number  
EP 04 25 4782

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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
Munich		17 November 2004	Vinci, V
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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