



(51) International Patent Classification:
C25D 5/02 (2006.01)

(21) International Application Number:
PCT/IB2011/003303

(22) International Filing Date:
22 December 2011 (22.12.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PCT/IB2010/003508
23 December 2010 (23.12.2010) RO

(71) Applicant (for all designated States except US): FCI
[FR/FR]; 18 Parc Ariane III, 3-5, rue Alfred Kastler, F-
78280 Guyancourt (FR).

(72) Inventor; and

(75) Inventor/Applicant (for US only): COMTE, Damien
[FR/FR]; 22, Grande Rue, F-25170 Chevigney-sur-l'Ognon
(FR).

(74) Agent: REGI, François-Xavier; FCI - IP Department, 18
Parc Ariane III, 3/5 rue Alfred Kastler, F-78284 Guyan-
court Cedex (FR).

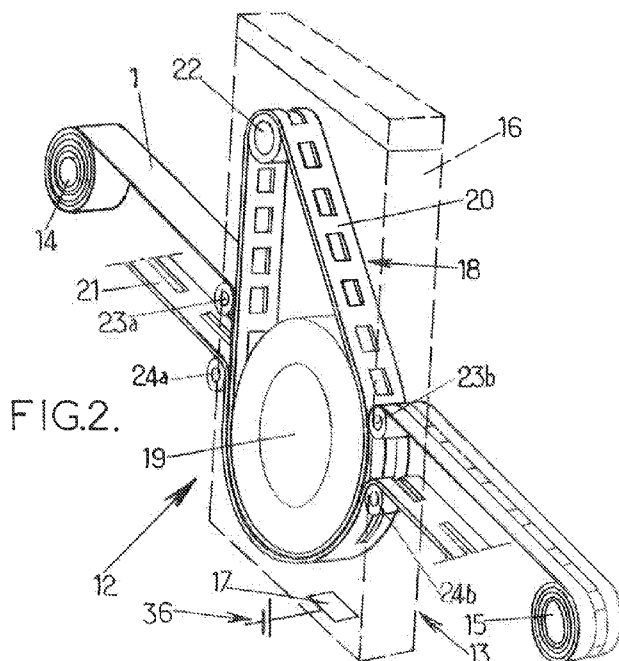
(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished
upon receipt of that report (Rule 48.2(g))

(54) Title: PLATING METHOD AND APPARATUS, AND STRIP OBTAINED BY THIS METHOD



(57) Abstract: A method for plating strips comprising:
providing a strip (1) of material, providing a masking belt
(18) comprising patterned windows, providing a tank (13)
with a plating solution, generating a continuous movement in
the cell of an assembly of the strip and masking belt, whereby
the structure of the masking belt masks portions of the strip in
the tank.

**PLATING METHOD AND APPARATUS, AND STRIP OBTAINED BY THIS
METHOD.**

FIELD OF THE INVENTION

5 The instant invention relates to plating methods and apparatus for the plating of strips. For instance, the plating method and apparatus is applicable to the manufacture of electrical terminals and electrical connectors, and strips obtained by these methods.

10 BACKGROUND OF THE INVENTION

 In this document the invention is described in relation to the manufacturing of electrical terminals for connectors used in automotive or telecommunication applications, but as it will be understood from the
15 following the invention can be used for plating any kind of strip of material and in particular flexible metal strips.

 In the application chosen for illustrating the invention strips to be plated are connector terminal strips. One may use rigid structures such as so-called
20 "lead frames" or "carriers" for supporting these electrical terminals. A lead frame or carrier enables to hold together the terminals during their manufacturing process, which makes a continuous manufacturing process possible on an industrial scale. At a final stage of the manufacture
25 process of the connector, the terminals are separated away from the frame or carrier, which is scraped.

 One of the steps of the manufacture of electrical terminals is the plating of a metallic conductor such as, for example gold, on their surface. The strip of lead
30 frames or carriers is continuously moved in an electroplating cell between two independent belt portions, which are used to carry the lead frames or carriers. There is a need to make this process more efficient.

 In the following, for the sake of simplification,
35 the word "carrier" is used for designating either a lead-

frame or any other kind of carrier.

SUMMARY OF THE INVENTION

The invention relates to a method for the
5 manufacture of plated strips.

This method comprises the provision of a strip, for instance a metallic strip. This strip comprises a top band, a bottom band, a structure joining together the top and bottom bands, and leads disposed between the top band and
10 the bottom band. For instance, these leads are designed to form electrical terminals for electrical connectors.

A masking belt is provided. The belt comprises a top band, a bottom band, and a structure joining together the top and bottom bands.

15 A tank is provided. For instance this tank is a metallisation cell with a chamber receiving a solution of an electrical conductor, and an electrode.

A continuous movement of an assembly of the strip and the masking belt is generated in the cell. The masking
20 belt masks at least partially the strip in the cell.

The electrical conductor is electroplated on the metallic strip in the solution by applying an electrical field between the strip and the electrode during the continuous movement. The electroplating occurs only on the
25 uncovered or unmasked portions of the strip.

With these features, no electrical conductor is applied on the masked portion of the strip. Since this portion may be scraped and/or not used, waste of plating material (gold for instance) is avoided and the efficiency
30 of the process is consequently improved.

In some embodiments, one might also use one or more of the features as defined in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics and advantages of the
35 invention will appear from the following description of

three of its embodiments, provided as non-limitative examples, and of the accompanying drawings.

On the drawings:

- Fig. 1 is a partial planar view of a metallic strip,
- Fig. 2 is a schematic partial perspective view of an apparatus according to a first embodiment,
- Figs. 3a and 3b are opposite exploded perspective views of a strip and belt assembly for the apparatus of Fig. 2,
- Fig. 4 is a view corresponding to Fig. 3b, and not exploded, and
- Figs. 5 and 6 are views corresponding to Fig. 4 for a second and respectively third embodiments.

On the different figures, the same reference signs designate like or similar elements.

DETAILED DESCRIPTION

Fig. 1 schematically shows a pattern of an electrically conductive strip 1. The strip 1 is formed as a repetition of a plurality of such patterns arranged the one after the others along the longitudinal direction X. The strip 1 may comprise hundreds of such patterns. The strip 1 is made from electrically conducting material, such as for example, a thin foil of copper which has been formed, for example stamped, as the shown shape. The strip 1 is provided sufficiently thin and resilient to be flexible with respect to the X axis, so as to be provided as a reel of material. The strip 1 comprises a carrier band 2 which carries electrical leads 3. The carrier band 2 may define a plurality of windows 4, each window enclosing a set of leads 3 which will form electrical terminals of a same electrical connector. The carrier band 2 comprises a top band 5 and a parallel bottom band 6 which extend along the direction X. The top and bottom bands 5, 6 are linked together by a structure 7, which ensures the

mechanical stability of the carrier band 2. For example, the structure 7 comprises a plurality of parallel pillars 8 extending along the transverse direction Y between the top 5 and bottom bands 6. In this particular example, a window 4 is defined between two subsequent pillars 8, and between the top and bottom bands 5, 6. The leads 3 are made integral with the carrier band 2 using a linking bar 9 which is a bar integral with the structure 7, as well as integral with any of the leads 3.

10 In the present example, the leads 3 extend sensibly straight along the direction Y. However, other geometries are possible. Each lead 3 extends between a first end 3a and a second end 3b, which are provided on opposite sides with respect to the bar 9. The first 3a and second 3b ends
15 are form tips which are more or less sharp depending on the application. All leads need not to have the same geometry. Some of the leads are longer than the others.

The carrier band 2 comprises a plurality of driving features 10. Such features 10 are for example holes 11
20 provided in the top and bottom bands 5 and 6 in equidistant fashion along the direction X, so as to cooperate with a driving device, not shown, such as motor-driven toothed wheels having teeth designed to engage the holes 11.

Referring to Fig. 2, an apparatus 12 is described.
25 The apparatus 12 comprises at least one electroplating cell or tank 13 as well as a feeding reel 14 and an uptake reel 15. The feeding reel 14 feeds the strip 1 to the electroplating cell 13. The strip is shown plain so as to simplify the drawing, but is has windows as shown on Fig.
30 1. In the electroplating cell 13, an electrically conductive material, in particular metal, is electroplated on the strip 1. The apparatus 12 may comprise one or more such cells 13 provided the one after the others, so as to apply a plurality of identical or different treatments to
35 the strip 1. The strip 1 is then wound again on the uptake

reel 15.

The cell 13 encloses a solution bath 16 which is a liquid in which a metal to be deposited on a strip 1 is diluted. The cell 13 further comprises an electrode 17 to which an electrical potential can be applied by a generator. The strip 1 is held at another potential so that the potential difference between the electrode 17 and the strip 1 causes metal of the bath 16 to plate the strip 1.

In the cell 13, the strip 1 is assembled with a masking belt 18, which masks portions of the strip 1 on which electroplating is not desired. A driving device 19, such as a roller, is rotated and used to drive the belt 18 in the cell 13.

In the cell 13, the strip 1 and the belt 18 are pressed against each other so that only the unmasked parts of the strip are plated with the diluted metal. In the shown embodiment, the strip 1 is held between two belt portions 20 and 21. The belt portion 20 is a continuous belt in direct contact with the driving device 19 and also with one or more additional rollers 22.

Two rollers 23a and 23b apply the strip 1 directly against the belt portion 20 within the cell 13. These rollers may be provided outside the cell 3 and/or used to apply an electrical potential to the strip. They engage the holes 11 to drive the strip 1.

The second belt portion 21 is applied directly on the strip 1 using rollers 24a and 24b. The second belt portion 21 may also be provided continuous (endless) using other rollers (not shown).

Figs. 3a and 3b schematically show the way the strip 1 is held between the two belt portions 20 and 21 in the bath. Figs. 3a and 3b are schematically shown with the straight strip 1 and the belt portions 20 and 21, but in fact they are wrapped around the driving device 19 as shown

on Fig. 2.

The belt portion 20 has a face 26 which faces the strip 1 and an opposite face 27 which is driven by the driving device 19. For example, the face 27 has
5 corrugations 28 which cooperate with complementary features of the driving device 19 so as to precisely drive the belt portion 20.

The belt 18 has a top band 29 which faces the top band 5 of the strip 1. The belt 18 also has a bottom band
10 30 which faces the bottom band 6 of the strip 1. Furthermore, the belt 18 is provided with periodic structures 31, the geometry of which mimics the geometry of the structures 7 of the strip 1. In the present example, where the strip 1 has pillars 8, the belt 18 is also
15 provided with pillars.

In the present case, windows 32 are provided in the belt 18, which correspond to the windows 4 of the strip 1. A recess or groove 33 is provided on the inner face of one or more of the belt portions 20, 21, it is sufficiently
20 large and deep for receiving the strip 1.

The belt portions 20 and 21 are also provided with inter-digital features, in order to precisely define their relative positions, in particular with respect to the longitudinal direction X. Indeed, any slippage or
25 differential movement of the belts along the direction X, and any offset between the structures of the belt and the strip ought to be avoided. For example, the belt portion 20 is provided with fingers 34 which cooperate with complementary holes or recesses 35 of the belt portion 21
30 so as to precisely define the position of the two belt portions relative to one another.

The belt 18 is provided in a material which is sufficiently strong to withstand the driving by the driving device 19, which can carry the strip without any slippage,
35 and which can also seal efficiently the part of the

structures which should not be electroplated, in particular in a bath which is agitated in particular by the movement of the moving parts. For example, the belt portions are made from a reinforced aramide overcoated with a silicone
5 coating adapted to provide the sealing ability.

Fig. 4 shows the strip 1 and belt 18 assembly, the strip 1 being masked by the belt 18. In this way, metal is electroplated only on the terminal leads and the bar 9. For example, nickel is electroplated in this embodiment.
10 In a second embodiment, as shown on Fig. 5, which can be alternative to the embodiment of Fig. 4, or after it, in another cell, the belt 18 is provided with a different geometry, so that only part of the leads 3 is submitted to electroplating. In particular, in this embodiment, only
15 the bottom part of the pins, below the bar 9, is submitted to electroplating, for example of tin.

In yet another embodiment, as shown on Fig. 6, which may be alternative or following the embodiments of Fig. 4 or 5, only the top part of the leads are
20 electroplated, for example by gold, by masking the bottom part of the leads 3 with the masking belt 18.

The manufactured leads can then be processed for the manufacture of electrical connectors, for example by overmolding the leads in plastic and separating away the
25 metallic frame.

CLAIMS

1. A method for plating of strips comprising:
 - providing a strip (1) of material,
 - 5 - providing a masking belt (18) comprising patterned windows,
 - providing a tank (13) with a plating solution,
 - generating a continuous movement in the cell of an assembly of the strip and masking belt, whereby the
 - 10 structure of the masking belt masks portions of the strip in the tank.
2. Method according to claim 1, in which the belt (18) comprises a first and a second belt portions (20, 21), each one of which masking a respective face of the strip
- 15 (1).
3. Method according to claim 2, wherein the first and second belt portions are provided with inter-digital features (34, 35), so that the movement applied to the belt (18) is transferred to the strip, and applying the
- 20 continuous movement to the belt.
4. Method according to one of the preceding claim, wherein
 - the tank is an electroplating cell (13) comprising an electrode,
 - 25 -the plating solution is an electroplating solution comprising an electrical conductor,
 - the method comprising electroplating the electrical conductor on the metallic strip (1) in the solution by applying an electrical field between the strip
 - 30 and the electrode during the continuous movement.
5. Method according to one of the preceding claims, comprising
 - providing a metallic strip (1) comprising a top band, a bottom band, a structure joining together the top
 - 35 and bottom bands, and leads disposed between the top band

and the bottom band, the leads being designed to form electrical terminals of electrical connectors,

- providing masking belt portions (20, 21) comprising a top band, a bottom band, a structure joining
5 together the top and bottom bands,

and wherein, in the tank, the top band (29) of the masking belt masks the top band (5) of the strip and the bottom band (30) of the masking belt masks the bottom band (6) of the strip.

- 10 6. A method for the manufacture of electrical terminals for electrical connectors, wherein the method comprises:

- providing a metallic strip (1) comprising a top band, a bottom band, a structure joining together the top
15 and bottom bands, and leads disposed between the top band and the bottom band, the leads designed to form electrical terminals of electrical connectors,

- providing a masking belt (18) comprising a top band, a bottom band, a structure joining together the top
20 and bottom bands, wherein the belt comprises a first belt portion (19), a second belt portion (20),

- providing a metallisation cell (13) having a chamber receiving a solution of an electrical conductor, and an electrode,

- generating a continuous movement in the cell of
25 an assembly of the metallic strip and masking belt, wherein the metallic strip is held between the first and second belt portions, and whereby the structure of the masking belt masks the structure of the strip in the cell,

- electroplating the electrical conductor on the
30 metallic strip (1) in the solution by applying an electrical field between the strip and the electrode during the continuous movement.

- 35 7. Method according to claim 6, wherein each of the belt portions comprises a top band, a bottom band, and a

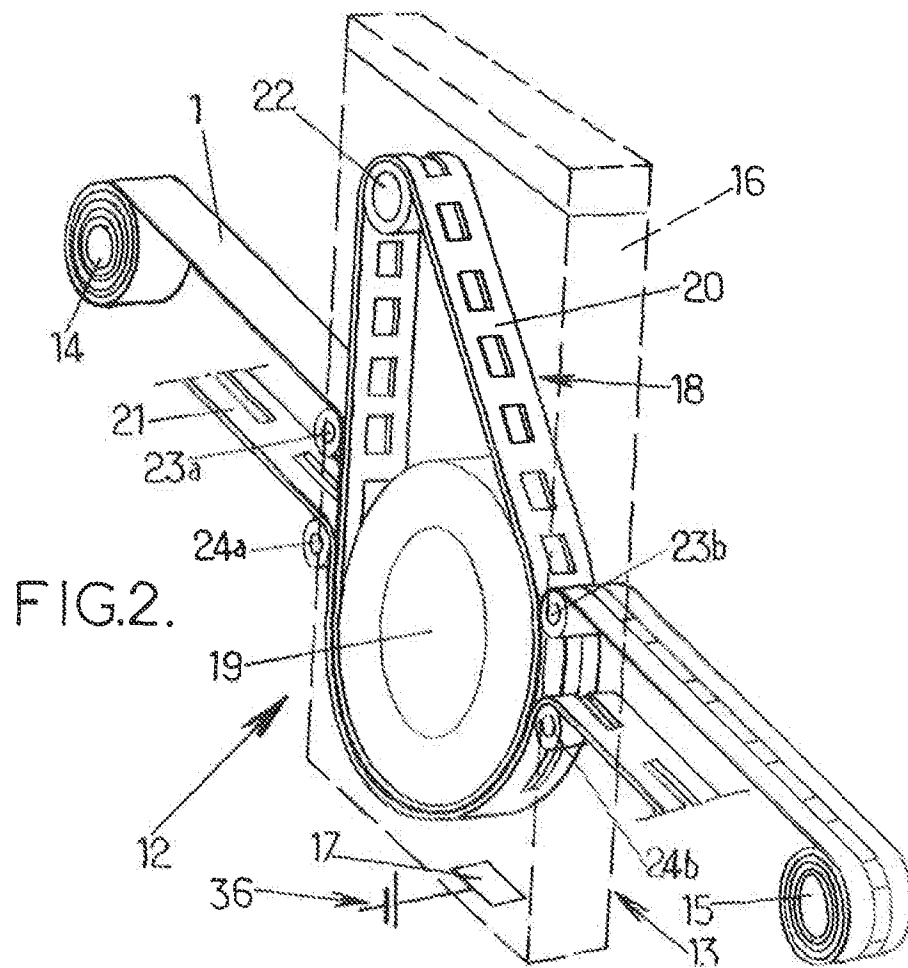
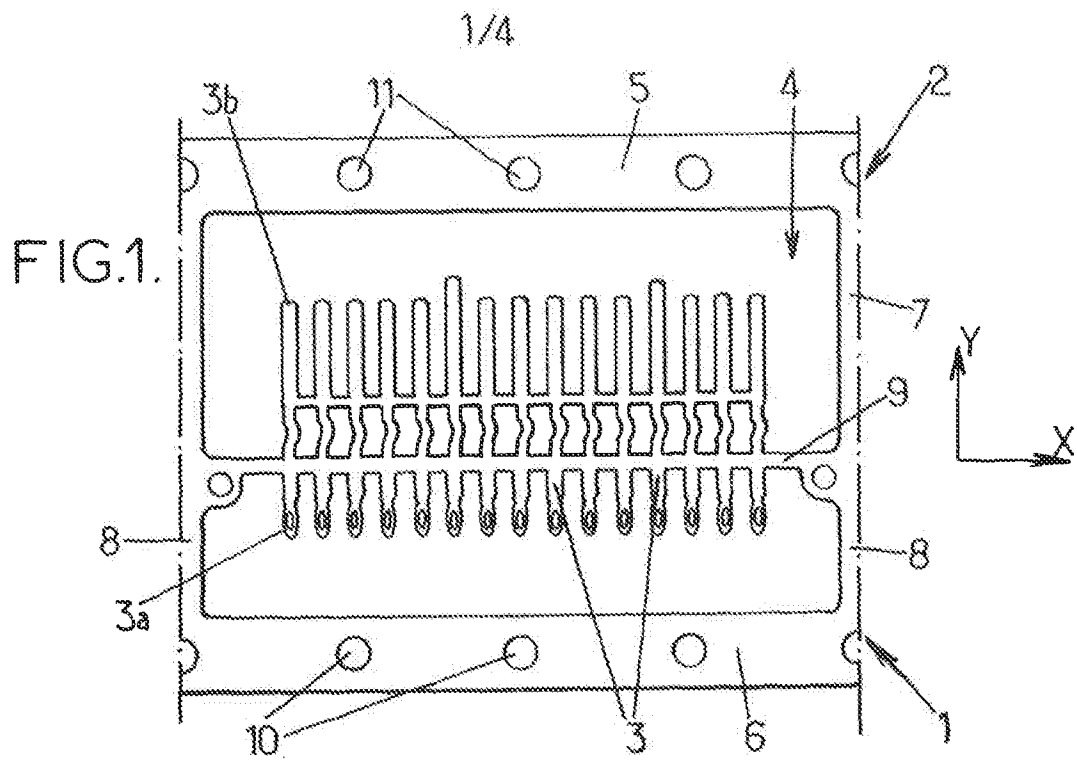
structure joining together the top and bottom bands, wherein, in the cell:

- the top band (29) of the first belt portion faces the top band of the second belt portion,
- 5 - the bottom band (30) of the first belt portion faces the bottom band of the second belt portion,
- the structure (31) of the first belt portion faces the structure of the second belt portion.

8. An apparatus for the plating of strips, wherein
10 the apparatus comprises:

- a feeding station (14) adapted to provide a strip (1),
- a masking belt (18) comprising patterned window,s
- 15 - a tank (13) for receiving a plating solution,
- a driver (19) adapted to generate a continuous movement in the tank of an assembly of the strip and masking belt, whereby the masking belt masks part of the strip in the tank.

20 9. An apparatus according to claim 8 further comprising a generator (36) to apply an electrical field between the strip and an electrode placed in the tank, during the continuous movement so as to electroplate an electrical conductor on the strip in the solution.



2/4

FIG.3a.

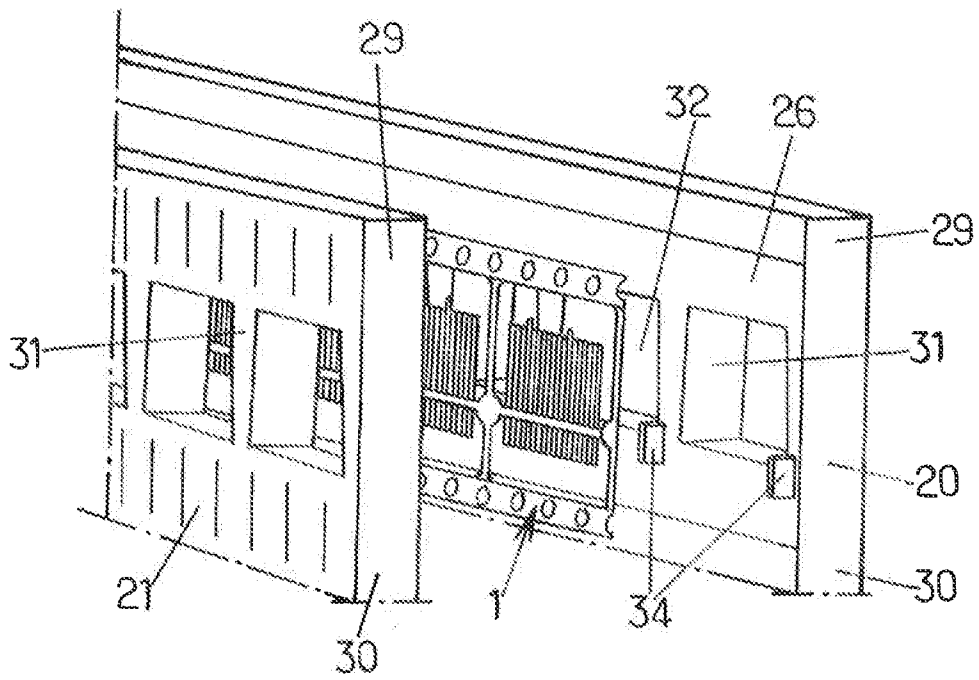
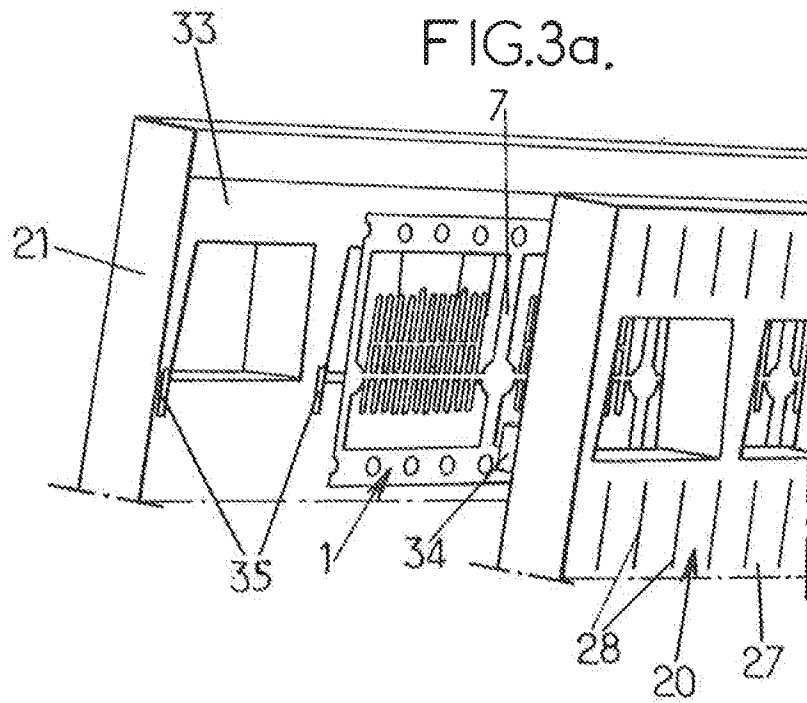


FIG.3b.

3/4

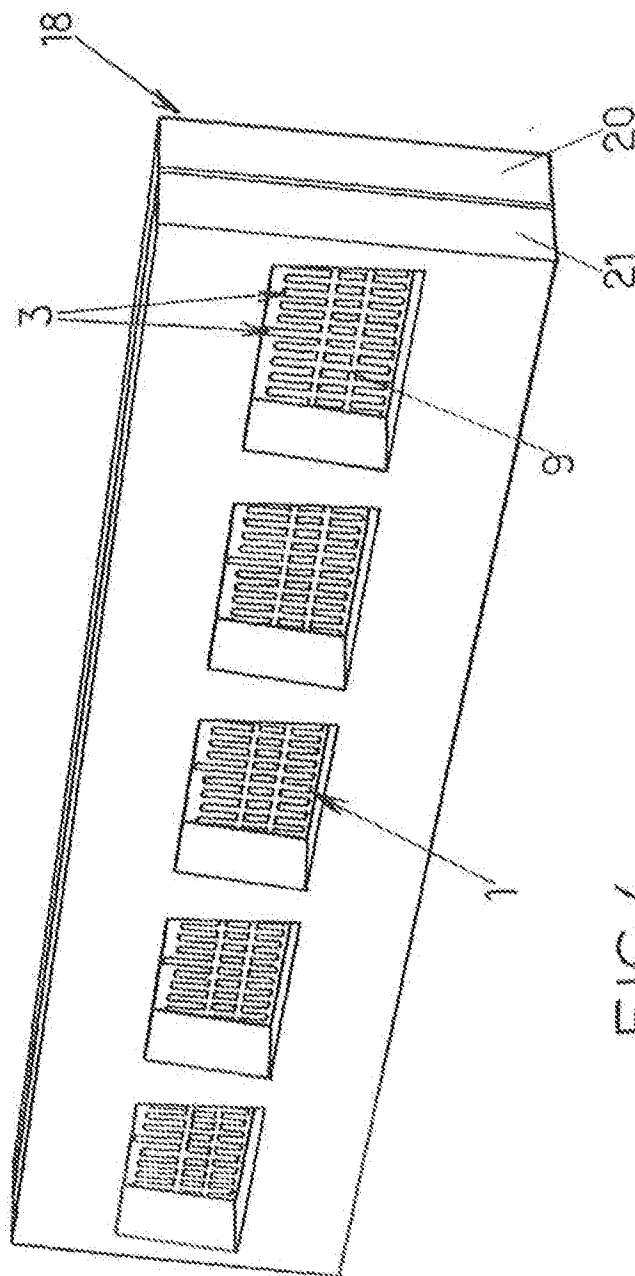


FIG. 4.

4/4

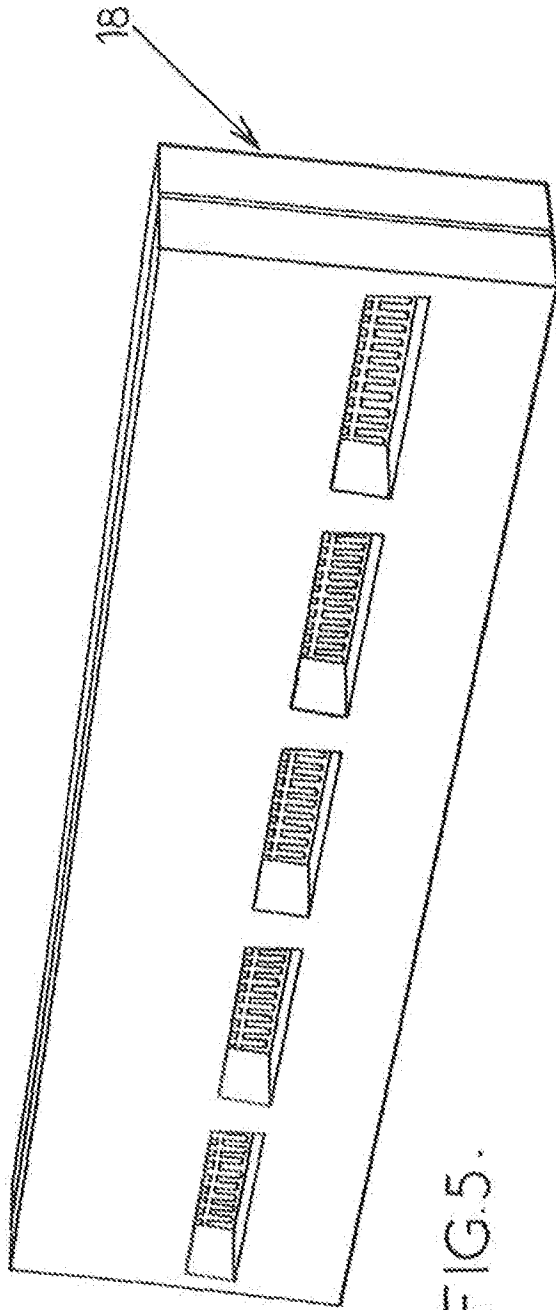


FIG. 5.

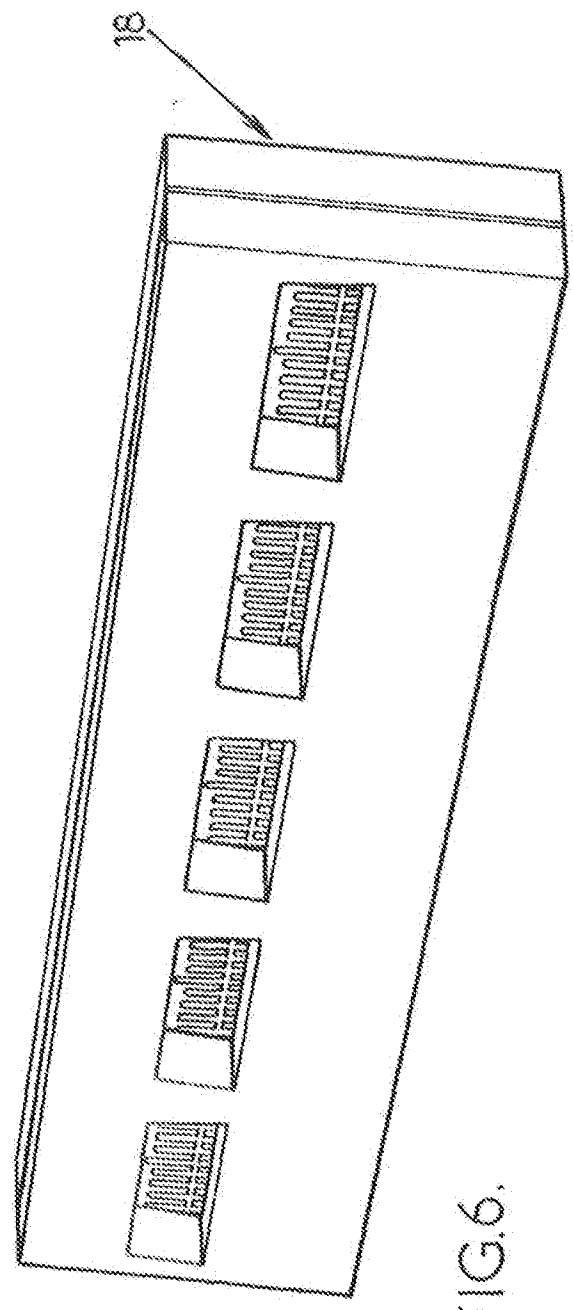


FIG. 6.