

Method for production of conducting element and
conducting element

5 The present invention relates to a method for produc-
tion of conducting element, which conducting element
consists at least of an elongated and essentially flat
electricity conductive conductor part, such as a band,
a stripe or a like, in which several electric com-
ponents, such as probes, LEDs, resistors and/or the
10 like bringing out the lighting operation or like
according to the use of the conducting element, are
being attached to one after another in the longitu-
dinal direction, and of a casing part, which conduc-
ting element is being manufactured by arranging the
15 conductor part and the components existing therewith
when viewed in a cross section totally surrounded by
a casing material forming the said casing part, by
exploiting a continuous manufacturing process, such as
extrusion or like.

20 In light operated guidance devices, that are meant
particularly e.g. to guide sports performances, it is
previously known to use e.g. lamps, that are connected
one after another to an electric conductor placed
25 inside a transparent pipe, which guide the athletes'
performance according to a predrafted programme. In
this case, when following the lamps getting lighted
one after another, the athlete may keep the previously
defined speed. The type of traditional solutions
30 described above are usually based on guidance devices,
that have been put together completely one by one from
separate parts and in which usually bulbs have been
used as lamps, that have been connected in series to
the electric conductor passing through a transparent
35 pipe. When using the type of guidance devices above
adequate attention must be paid to the tightness of
the casing part, so that water may not enter inside

the guidance device, when the same is being used in damp circumstances or e.g. in a swimming pool.

5 On the other hand it is known to use also certain type of electric guidance devices or like, that are manufactured one by one and that may be used e.g. the way described above when being coupled to each other one after another. This type of solutions are usually produced by molding the same inside transparent
10 plastics, that is why when coupling the guidance devices to each other completely separate coupling wires must be used, that must naturally be protected separately as well when the same are being used e.g. for guiding purposes under particularly demanding
15 circumstances, such as in inflammable or the like accommodations. Protection of the intermediate wires require thus careful installation or auxiliary measures and components during actual production of the devices on the one hand e.g. to prevent sparking to
20 the surroundings and on the other hand to protect the electric wires and actual lighting devices from water or humidity of the surroundings.

Furthermore e.g. from US Patent 5,496,427 it is
25 previously known to produce fully capsulated lighting strip based on electroluminescence by extrusion. This type of solution, that is purely based on electroluminescence, may be carried out in a totally traditional way by using merely elongated leads and intermediate
30 stripes, that continue constant (cf. electric cables). Instead of the above, with a structure, that is based according to the present invention on printed circuit board technics, it is possible to achieve a conducting stripe, that operates particularly dynamically as well
35 and in which there exists e.g. a light effect, that moves along the guiding direction. This type of solution may not in any way be achieved by the stripe according to the above US Patent, that is based on

electroluminance, because it operates by on/off principle only.

5 On the other hand it is no doubt previously known from
US Patent 5,193,895 as well to produce an elongated
stripe for lighting purposes. In this patent there has
not been presented, however, particularly a moisture
resistant end product, that may be achieved just by
exploiting extrusion being mentioned above. The type
10 of solution is thus based on at least two separate
parts, in which case moisture will cause always
problems in practice, when the same enters between the
part layers. With this type of solution it is not
either possible to end up to a conducting stripe, that
15 operates dynamically as described above, but the
conducting stripes enabled by the solution in question
always operate by on/off principle.

20 Furthermore in EP Application 760448 (which applicati-
on has become public, however, only after the priority
date of the invention in question) there has been
represented a solution, which is first of all based on
two or more continuous conducting bars passing
throughout the whole conducting stripe, into which
25 LEDs are connected one after another in the longitu-
dinal direction. The first variation in the applicati-
on comprises a solution, which consists of two
elongated conducting bars, into which there has been
attached LEDs, which entirety has been extruded by a
30 suitable plastic based paste to achieve a built-in
elongated conducting stripe. The other variation in
the application is such, that in addition to the
conducting bars a binding stripe is being fed to the
extrusion apparatus, that is unwound from a roll and
35 that is continuous in the longitudinal direction and
on top of which there exists separate printed circuit
boards, in which the LEDs have been installed. Because
in this variation there has been used conducting bars

as well, that are continuous in the longitudinal direction, and that are attached to the contact surfaces existing in those totally separate printed circuits by means of separate pressing rollers, it is
5 not possible with the type of solution in question to achieve such dynamic operation of the conducting stripe as described above, but instead the solution in question is further based on traditional on/off use.

10 In the solution in question the starting point is thus always such, that the conducting stripe comprises at least two or more conducting bars passing continuously from one end to the other end of the same and into
15 which the LEDs are connected either directly or by using furthermore a binding stripe, on which the separate printed circuit boards equipped with LEDs have been supported. This is why the solution in question is particularly with a view to manufacturing
20 technics as well as by the construction of the same disproportionately complicated, because in connection with the same there must furthermore be used first of all conducting bars, continuing in the longitudinal direction, because of the printed circuit boards, that
25 are electrically totally separate in respect to each other, to connect the printed circuit boards and LEDs existing therewith to each other to achieve at least a static operation of the conducting stripe.

30 A method of this invention has an object of providing a decisive remedy to the above discussed problems and, thus, of raising substantially the existing prior art. In order to achieve this object, the method of the invention is substantially characterized in, that the
35 electric components of a conducting element, that enables preferably dynamic use, are being attached preferably by means of surface mounting technics to an electric conductor layer, such as to a copper coating or like of a basic material, that is made of plastics,

such as polyamide, polyester, polyethylene naphthalate or like, of the conductor part, that is based on so called printed circuit board technics, whereby the electric conductor layer continues essentially uninterruptedly over the whole length of the conducting element, whereafter the entirety being brought out is being surrounded by a casing material, that is based on plastics such as PVC, polyurethane, olefin and/or like.

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The most essential benefits of the method of the invention include its simplicity and operating reliability, which enables significantly more profitable production when compared to nowadays conducting elements. The method according to the invention enables first of all a very low profile, thanks to which conducting elements according to the invention may be used e.g. in connection with vinyl floors, because a guiding element enabled by the method, the height of which is below 2 mm, may be installed completely to the same level as the vinyl floor surface surrounding the same. The method according to the invention enables that as well, that the conducting element is water and gas proof, thanks to which a conducting elements being produced by the method according to the invention may be used both in damp or wet rooms/surroundings as well as e.g. in inflammable surroundings. The method according to the invention enables a structure, that has a very strong surface, wherein a conducting element being built e.g. into a floor does not significantly differ from the original vinyl floor surrounding the same by its surface hardness. The method according to the invention is based on very usual extrusion technics in principle, which however, when being used in this connection enables surprising possibilities with a view to production and final dimensions of the conducting element to be produced by the method, whereby the

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5 dimensions, shapes and electric characteristics of the
conducting element to be produced may be altered very
easily by making only the necessary simple technical
changes during each working phase. By exploiting the
method according to the invention it is possible to
10 produce a continuous and flexible conducting element,
that may be stored on roll and in addition to the
above straight bar-like conducting elements naturally
as well. The invention enables furthermore production
of a conducting element, that is secured electrically
15 by loop principle merely thanks to the conductor part
existing therewith, that has been carried out by
printed circuit board technics. It may be stated in
this connection as well, that the bendability of e.g.
the solution particularly according to the above EP
20 application may be questionable, because in this
solution the conducting bars are being pressed against
the contact surfaces existing in the conducting
printed circuit boards, in which case when bending the
conducting stripe, the components in question probably
get separated, in which case the electric contact
breaks.

25 Thanks to the invention it is possible to produce
conducting stripes, that differ from the visual point
of view from all previous solutions as well, by
feeding e.g. differing coating colour layers to the
extrusion apparatus. The colour layers may be of the
same colour as the background, self luminous or e.g.
30 reflective. It is furthermore possible to arrange e.g.
lences in connection with the colour layers, that are
placed on the LED-component surfaces. In this way it
is possible within a solution according to the inven-
tion to combine intelligently effect of both light and
35 reflective/self-luminous colour.

The non-independent claims directed to the method said worth preferred embodiments for the method of the invention.

5 The invention relates also to a conducting element to be produced by the method, that is defined in more detail in the preamble of the independent claim directed thereto. The features essentially characte-
10 ristics for the conducting element are set forth in the characterizing section of the same claim.

 The most significant benefits of the conducting element according to the invention include simplicity and operating reliability of production, construction
15 and use of the same. Particularly use of a so called continuous manufacturing process, that means so called extrusion, enables first of all that, that the length of a conducting element according to the invention may be even hundreds of meters. The conducting element
20 according to the invention may be produced as a completely intergrated structure and e.g. an essentially water and gas tight or moisture resistant structure. The conducting element according to the invention may be dimensioned very small, in which case
25 it may be used e.g. totally built-in with a vinyl floor, in which case the surface strength and the like characteristics of the same further correspond essentially to the characteristics of the vinyl floor surrounding the same. In addition to that, thanks to
30 the conductor part being carried out electrically by so called printed circuit board technics, the conducting element may be produced in a way, that it operates either statically (no alteration of direction) or dynamically (with alteration of direction), in which
35 case the conducting element operates despite the fact, that some of the electric components of the same stop functioning for some reason. In case the conducting element needs to be prepared it may be carried out

5 simply by changing pieces of the conducting elements,
the length of which correspond one or several sections
of the same, by using e.g. soldering or mechanical
couplings within joints, whereafter the jointing
10 points may be sealed furthermore with a plastic matrix
corresponding e.g. to the surface of the stripe. The
conducting element according to the invention may thus
be exploited in most heterogeneous connections and
uses, e.g. in public accommodations, ship surround-
15 dings, aeroplanes, terminals etc. or for normal
guiding purposes, for emergency or safety lighting
purposes, for control, guidance use, monitoring,
measuring and/or observing purposes etc.; the conduc-
ting element according to the invention may be produ-
20 ced according to the nowadays LLL-requirements (Low
Location Lighting).

The invention will now be described in more detail
with reference made to the accompanying drawings, in
25 which

Fig. 1 shows one advantageous general principle of
the method according to the invention and

25 Figs 2a and 2b

show one advantageous conductor stripe being
produced by the method according to the
invention as a cross-section (fig. 2a) and a
covering band being used in a conductor
30 stripe according to the invention seen from
above (fig. 2b).

The invention relates to a method for production of
conducting element, which conducting element consists
35 at least of an elongated and essentially flat electri-
city conductive conductor part 1; 1', such as a band,
a stripe or a like in which several electric com-
ponents 2; 2', such as probes, LEDs, resistors and/or

the like bringing out the lighting operation or like according to the use of the conducting element, are being attached to one after another in the longitudinal direction s, and of a casing part 3. The conducting element is being manufactured by arranging the conductor part and the components existing therewith 1; 1', 2; 2' when viewed in a cross section totally surrounded by a casing material 3' forming the said casing part 3, by exploiting a continuous manufacturing process, such as extrusion or like. The electric components 2' of a conducting element, that enables preferably dynamic use as well, are being attached preferably by means of surface mounting technics to an electric conductor layer 1'b, such as to a copper coating or like of a basic material 1'a, that is made of plastics, such as polyamide, polyester, polyethylene naphthalate or like, of the conductor part 1', that is based on so called printed circuit board technics, whereby the electric conductor layer 1'b continues essentially uninterruptedly over the whole length of the conducting element, whereafter the entirety being brought out is being surrounded by a casing material 3', that is based on plastics such as PVC, polyurethane, olefin and/or like.

Furthermore as an advantageous embodiment, the electric conductor layer 1'b, such as copper coating or like of the conductor part, that is made of a continuous flexible printed circuit board, is being coated at least by the parts surrounding the electric components 2' by a covering colour, film 1'c or like before processing of the casing material 3'.

Furthermore as an advantageous embodiment of the method with reference particularly to fig., 1 the electric components 2' are being attached during a first phase I by surface processing technics to the flexible conductor part 1', that is preferably unwound

from a roll, whereafter at least the covering colour, stripe 1'c or like surrounding at least the electric components 2' of the conductor part 1' is being attached to the same during a second phase II and wherein the same is being extruded during a third phase III by a casing material 3' surrounding the same essentially overall. Naturally it is possible to vary the above working stages e.g. in a way, that the electric components are being placed not until the covering stripe 1'c has been installed etc.

Futhermore as an advantageous embodiment of the method, during production of the conducting element co-extrusion is being exploited in other words by using e.g. three parallel extrusion nozzles particularly for colouring the longitudinal sectors of the conducting element to be produced alternatively or for a corresponding purpose.

With reference to the method described above during a premanufacturing stage the desired lay-out of the conductor part 1' is being designed and produced. Thereafter a film is being produced from the lay-out in question, the size of which is e.g. 1500 mm x 600 mm, whereafter a sieve for the silk-screen is being produced from the film. After this the protective colour is being brought by means of the sieve on top of the electric conductor layer 1'b existing on the basic material 1'a of the conductor part, whereafter etching of the conductor part 1' is being carried out, thanks to which the desired electric lay-out of the copper surface is achieved.

With the method described above it is possible to produce several parallel conductor parts to the same preform in the same connection, which are being cut from each other after the stages described above and driven on roll, whereafter the continued process has

been described above. The uninterrupted length of a continuous printed circuit board being produced e.g. the way described above and thanks to that the conducting element as well may be easily even 300 m.

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A conducting element according to the invention consists thus of an elongated electricity conductive conductor part 1; 1', which has several successive electric components 2; 2' that bring out e.g. a lighting operation, which entirety has furthermore being surrounded by means of a casing part 3; 3' protecting the same. The electric components 2' of a conducting element, that enables at least dynamic use, are attached preferably by means of surface mounting technics to an electric conductor layer 1'b, such as to a copper coating or like to existing on a basic material 1'a, that is made of plastics, such as polyamide, polyester, polyethylene naphthalate or like, of the conductor part 1', that is based on so called printed circuit board technics, whereby the electric conductor layer 1'b continues essentially uninterruptedly over the whole length of the conducting element, which entirety is surrounded throughout by a completely uniform casing material 3', that is based on plastics, such as PVC, polyurethane, olefin and/or like.

Furthermore as a particular advantageous embodiment particularly to cover the e.g. copper coated outer surface of the conductor part 1', that is made of a continuous flexible printed circuit board, on top of the same there is arranged a covering colour film 1'c or like at least on the parts surrounding the electric components 2'. Particularly when a separate covering film is being used e.g. as shown in fig. 2b, in which there has been prepared during a premanufacturing stage openings at points corresponding the places of the components 2'a, 2'b to be connected to the conduc-

tor part 1', the solution is advantageous in such respect, that by using a suitable material thickness therewith it is possible to even the outer surface of the conductor part particularly with a view to the extrusion stage. Small alterations in height on the outer surface of the conductor part 1' may be eliminated during manufacturing e.g. by altering drawing speed and/or extrusion pressure during extrusion.

Furthermore as an advantageous embodiment in connection with a conducting element, that is meant to be installed particularly built-in with a vinyl floor, the total thickness v of the conducting element is at the most 2 mm, whereby the thickness v of the casing material 3' of the lowermost part of the conductor part 1' is preferably 0,1 - 0,3 mm.

As a particularly advantageous embodiment with reference particularly to the general principle of the method shown in fig. 1, the conducting element has been produced from a flexible conductor part, in which case the produced conducting element may be furthermore stored on roll. When exploiting in other respects nowadays technology existing completely already, it is possible to produce e.g. conducting element according to the invention, the breadth w of which is e.g. between 5-1500 mm. The mentioned values may not in any way limit the solution being exploited in this connection, because it is possible to achieve smaller/greater dimensions than presented above by very simple arrangements.

Furthermore as an advantageous embodiment the conductor part 1' of the conducting element has been formed of at least two or several printed circuit boards or printed circuit board layers, that are electrically isolated from each other placed on one another. It is thus possible to produce e.g. a conducting element as

well, in the printed circuit board of which there exists mutually differing and electrically isolated copper coatings on both opposite surfaces of the same. This type of embodiments have not been shown in the drawings, because they may be easily constructed in practice as embodiments, that are electrically isolated from each other, by arranging the coating conducting electricity only on one side of each printed circuit board layer. With the type of solutions it is possible to lead/transmit e.g. separate groups, canals passing in different kinds of buildings. In this way it is also possible to increase information being transmitted by the conductor stripe without however essentially increasing the total thickness of the conducting element. Furthermore the electric components of the conducting element may comprise LED-matrices being placed one after another in the longitudinal direction as well, e.g. to form letters, figures or text. In addition to that multicolour LEDs may be used in certain kinds of embodiments as the electric components, in which case depending on the situation the colour of the LEDs is most suitable to each operating purpose (green/red etc.).

It is obvious, that the invention is not limited to the above described or discussed embodiments, but it can be subject to even major modifications within the context of the basic concept. As explained above it is thus naturally possible to produce elongated stiff structures as well apart from the type of flexible conducting elements as explained above. It is naturally possible to exploit e.g. base rods made of plastics in connection with the type of flexible structures as described above as well, when the conducting elements are being used e.g. in connection with textile floors or by exploiting aluminium or steel structured base rods when the same are being used particularly in connection with stone floors, in which it is not

possible to make recessions or grooves, so that the conducting element could be built in the floor. It is naturally obvious as well, that it is advantageous to produce the conducting element according to the invention in a way, that it has parts of certain length, according to which the conducting element may be cut and repaired afterwards. The method according to the invention may be exploited in such a way as well, that instead of coating or colouring of the conductor stripe, in connection with the extrusion a casing material is being used, the desired parts of which are e.g. opaque and from certain points furthermore transparent or see-through. Thanks to the moisture resistant structure enabled by the invention it is naturally important to pay attention to the moisture isolation of the mutual joints of e.g. the conducting elements to be coupled to each other one after another or of conducting elements and control unit/power source, by using a joint material, that is suitable in this connection e.g. castable polyurethane.

Claims:

1. Method for production of conducting element, which conducting element consists at least of an elongated and essentially flat electricity conductive conductor part (1; 1'), such as a band, a stripe or a like in which several electric components (2; 2'), such as probes, LEDs, resistors and/or the like bringing out the lighting operation or like according to the use of the conducting element, are being attached to one after another in the longitudinal direction (s), and of a casing part (3), which conducting element is being manufactured by arranging the conductor part and the components existing therewith (1; 1', 2; 2') when viewed in a cross section totally surrounded by a casing material (3') forming the said casing part (3), by exploiting a continuous manufacturing process, such as extrusion or like, characterized in, that the electric components (2') of a conducting element, that enables preferably dynamic use, are being attached preferably by means of surface processing technics to an electric conductor layer (1'b), such as to a copper coating or like of a basic material (1'a), that is made of plastics, such as polyamide, polyester, polyethylene naphthalate or like, of the conductor part (1'), that is based on so called printed circuit board technics, whereby the electric conductor layer (1'b) continues essentially uninterruptedly over the whole length of the conducting element, whereafter the entirety being brought out is being surrounded by a casing material (3'), that is based on plastics such as PVC, polyurethane, olefin and/or like.
2. Method according to claim 1, characterized in, that the electric conductor layer (1'b), such as copper coating or like of the conductor part, that is made of a continuous flexible printed circuit board,





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16

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is being coated at least by the parts surrounding the electric components (2') by a covering colour, film (1'c) or like before processing of the casing material (3').

3. Method according to claim 1 or 2 above, **characterized** in, that the electric components (2') are being attached during a first phase (I) by surface processing technics to the flexible conductor part (1'), that is preferably unwound from a roll, whereafter at least the covering colour, film (1'c) or like surrounding at least the electric components (2') of the conductor part (1') is being attached to the same during a second phase (II) and wherein the same is being extruded during a third phase (III) by a casing material (3') surrounding the same essentially overall.

4. Method according to any of the claims 1-3 above, **characterized** in, that during production of the conducting element co-extrusion is being exploited particularly for colouring the longitudinal sectors of the conducting element to be produced alternatively or for a corresponding purpose.

5. Conducting element, which consists at least of an elongated and essentially flat electricity conductive conductor part (1; 1'), such as a band, a stripe or a like, in which several electric components (2; 2'), such as probes, LEDs, resistors and/or the like bringing out the lighting operation or like according to the use of the conducting element, are attached to one after another in the longitudinal direction (s), and of a casing part (3), wherein the conductor part and the components existing therewith (1; 1', 2; 2') are arranged when viewed in a cross section totally surrounded by a casing material (3') forming the said casing part (3), by exploiting a





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17

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continuous manufacturing process, such as extrusion or like, characterized in, that the electric components (2') of a conducting element, that enables preferably dynamic use, are attached preferably by means of surface processing technics to an electric conductor layer (1'b), such as to a copper coating or like to existing on a basic material (1'a), that is made of plastics, such as polyamide, polyester, polyethylene naphthalate or like, of the conductor part (1'), that is based on so called printed circuit board technics, whereby the electric conductor layer (1'b) continues essentially uninterruptedly over the whole length of the conducting element, which entirety is surrounded throughout by a completely uniform casing material (3'), that is based on plastics, such as PVC, polyurethane, olefin and/or like.

6. Conducting element according to claim 5, characterized in, that the electric conductor layer (1'b), such as copper coating or like of the conductor part, that is made of a continuous flexible printed circuit board, is coated at least by the parts surrounding the electric components (2') by a covering colour, film (1'c) or like.

7. Conducting element according to claim 5 or 6, characterized in, that the total thickness (t) of a conducting element, that is meant particularly to be assembled to a vinyl floor, is at the most 2 mm, whereby the thickness (v) of the casing material (3') of the lowermost part of the conductor part (1') is preferably 0,1 - 0,3 mm.

8. Conducting element according to any of the claims 5-7 above, characterized in, that the conducting element comprises a flexible structure, that may be stored on a roll and the breadth (w) of which is preferably 5-1500 mm.



9. Conducting element according to any of the claims 5-8 above, **characterized** in, that the conductor part (1') of the conducting element is formed of at least two or several printed circuit board layers, that are placed on top of the other and that are electrically isolated from each other.
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10. Conducting element according to any of the claims 5-9 above, **characterized** in, that the electric components (2) of the conducting element comprise one or several letter or arrow shaped, text-like or corresponding LED-matrices being placed one after another in the longitudinal direction and/or one or several multicolour LEDs particularly for increasing the information value of the conducting element.
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