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(54) PROCEDURE FOR OBTAINING A REFLECTIVE WIRE FOR ROAD SAFETY, REFLECTIVE WIRE OBTAINED BY SAID PROCEDURE, AND MESH INCLUDING SAID WIRE

(57) Procedure for obtaining a reflective wire for road safety, reflective wire obtained by said procedure, and mesh including said reflective wire

It allows to increase road safety and reduce accidents on roads, the procedure comprising at least the following stages: a) extraction of the wire by winding it; b) pretreatment of the wire, wherein the wire surface is cleaned; c) drying of the wire; d) application of a reflective cover; e) curing of the reflective cover; and f) winding of the reflective wire.

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Description

OBJECT OF THE INVENTION

[0001] The present invention falls within the technical field of road safety, and more specifically that of optical signaling devices and systems.

[0002] The object of the present invention is a process for obtaining a reflective wire, by means of which it is possible to increase road safety and reduce accidents on roads.

BACKGROUND OF THE INVENTION

[0003] Currently. it is now widely known that driving in poor visibility conditions is a determining and triggering factor for many traffic accidents. Among the different low visibility situations that we can encounter, "night driving" is the most frequent. At night, visibility is limited to the range of the headlights, and is always lower than that which we would have in daylight.

[0004] On the other hand, during this same period of the day, the presence of wild animals on the roads is more frequent. In most cases, they are dazzled by vehicles lights and they remain motionless on the road, leading to fatal consequences.

[0005] Poor nighttime visibility, linked to the greater presence of wild animals on the roads, means that during this time period there is a greater number of accidents due to road departures or runovers, despite the fact that fewer vehicles are circulating compared to the rest of the day.

[0006] On roads where vehicles circulate, different types of signs are known (road markings, vertical signs, etc.) and in recent decades, in order to improve road safety, these signs have begun to be made with colors and surfaces that improve their visibility for drivers, especially in low-light conditions, such as during night driving.

[0007] For these situations in which lighting is poor, the most commonly used solution is to take advantage of the light from vehicle headlights to highlight the visibility of the signs. Specifically, the beam of light that hits the signs is used and reflected back towards the vehicle, increasing their perception by the driver. This effect is achieved by incorporating optical reflectors on the surface of the signs. There are different types of optical reflectors, such as specular or microspheres.

[0008] On the other hand, in order to avoid animal accidents on the roads, those responsible for road design often plan the installation of fences that prevent the presence of animals on the roadway. Specifically, in many countries it is common for all expressways to have this type of element. In this sense, the types of fences commonly used for this purpose are wire mesh, such as knotted mesh, progressive welded mesh, simple twist mesh, etc.

[0009] The technical problem here is therefore to find an alternative solution to current systems that would facilitate driver orientation while avoiding the presence of animals on the road, thereby improving road safety and helping to reduce the number of road accidents.

DESCRIPTION OF THE INVENTION

[0010] The present invention solves the technical problem mentioned above by providing a method for obtaining reflective wire for road safety. Thus, this wire constitutes a measure which allows increasing road safety and reducing roads accidents.

[0011] Specifically, the present invention allows creating meshes or gratings made with wires, in which part or all of them have a reflective surface. This feature allows to visually delimit of the roadway boundaries, facilitating orientation and driving, while preventing the entry and presence of animals on the road, and consequently helps to reduce accidents and increase safety.

[0012] According to a first object of the invention, the method comprises at least the following stages: a) extracting the wire by winding it; b) pre-treating the wire, wherein the wire surface is cleaned; c) wire drying; d) applying a reflective cover; e) curing the reflective cover; and f) winding the reflective wire.

[0013] Furthermore, it is provided that the method additionally comprises a stage of straightening the wire, carried out between stages a) and b).

[0014] Likewise, it has been considered that, following stage e) of curing, the process may additionally comprise the following stages: application of a protective layer, where the wire is covered with a layer of transparent lacquer to maintain the integrity of the reflective cover; curing of the protective layer until the applied lacquer layer is completely dry.

[0015] Each of these stages will be explained in more detail later.

[0016] In accordance with another object of the invention, a reflective wire is described, which is composed of the following layers located concentrically from the inside to the outside:

- a metallic core;
- a reflective cover.

[0017] Wire's cross section is constant and preferably circular.

[0018] The core can be made of any metallic material (steel, copper, aluminum, brass, etc.). In a preferred embodiment, the metallic core is made of grey steel, or with a protective layer against corrosion (galvanized, galvanized or with a Zn-Al alloy) or directly made of stainless steel.

[0019] The reflective cover is composed of at least one layer of paint or enamel, and reflective optical elements. Regarding the paint or enamel layer, this can be of any color, preferably being a transparent monolayer, white monolayer, or bilayer (white + transparent). Regarding the reflective optical elements, these may have any

shape. In a preferred embodiment, the reflective elements are substantially spherical or flat. Spherical reflective elements are known in the art as *microspheres* and flat ones as *flakes.*

[0020] Furthermore, it has been foreseen that the reflective wire may additionally comprise a protective layer, which constitutes a cover whose mission is to shield the reflective cover, preventing the dissociation of the optical elements both during the manufacturing process of the mesh and throughout its useful life. In order not to affect the reflective capacity of the product, this protective layer is transparent.

[0021] In accordance with another object of the invention, a mesh is described which includes the reflective wire described herein. It is desired to clarify at this point that when the term "mesh" is mentioned here, it also refers to a panel or grid formed from a plurality of reflective wires described herein.

[0022] In this sense, there are various types of wire fencing that can be used to delimit roads. From the simple use of one or several rows of single wire, fixed to posts, to strands of various wires, barbed wire, to more complex solutions such as woven or welded mesh. The most common are knotted mesh, welded mesh (called panel when rigid), simple twisted mesh and triple twisted mesh.

[0023] In cases where the enclosure is made up of several wires, the reflective capacity can be incorporated into all or part of them. Given the objective of the invention, the preferred embodiment is an enclosure that has one or several longitudinal wires with reflective capacity, not excluding any other solution in this regard.

PREFERRED EMBODIMENT OF THE INVENTION

[0024] A detailed explanation of a preferred embodiment of the method object of the invention is provided below.

[0025] The process in which the wire is coated with a reflective cover, and optionally with a protective layer, can be carried out in an independent process or incorporated as a further phase in a previous wire coating process, such as zinc plating, galvanizing, Zn-Al coating or plastic coating. In order to simplify this description, the process will be explained as if it were independent, but knowing that it can be incorporated in line with other previous wire coating processes.

[0026] Similarly, the procedure is explained for a circular section steel wire with a diameter between 1.0 and 8.0 mm and galvanized, and can be extrapolated to other materials, sections or previous coatings among those mentioned above.

[0027] According to a preferred embodiment, the process for obtaining the reflective wire comprises the following stages:

- Wire winding.
- Wire straightening.
- Pretreatment.
- Drying.
- Application of a reflective cover.
- Curing of the reflective cover.
- Application of the protective layer.
- Curing of the protective layer.
- Winding or spooling of the wire.

[0028] At the entrance to the process, the wire is coiled in a container that can be a spool or a winder. The process is continuous, which means that the wire is unrolling at the beginning of the process and advances at a constant speed through each of the steps, ending with the winding in another container that can also be a spool or winder. The advance of the wire along the steps is produced by the effect of the pull provided by the winding element (spooler or winder). The incorporation of new raw material into the process is carried out without stopping the installation, by welding the initial end of the wire of a winder or spool to the final end of the next winder or spool.

[0029] The process begins with the extraction of the wire through its winding. This winding is preferably carried out with the container in a vertical position (the axis of the tank in a vertical position). The extraction of the wire can be done either statically or dynamically. In static winding, the container does not rotate and the wire is drawn off from the top of the container and then returned to advance horizontally through the coating process. In horizontal winding, the container rotates on a horizontal platform (which may or may not be motorized) and the wire is drawn off tangentially and in a horizontal direction.

[0030] Due to the vice that the wire may suffer as a result of its resistance and coiling, a straightening step may be necessary. This is carried out with two plates of grooved rollers placed one after the other and positioned so that their planes form a 90° angle. Each of the plates can have five or seven grooved rollers that can be brought together in order to straighten the wire. The dimensions of the rollers and their grooves depend on the diameter of the wire.

[0031] Next, the wire enters the pretreatment stage. In this phase, the surface of the wire is cleaned and a product is applied to it that will improve the adhesion of the reflective cover that is subsequently applied. There are different means for cleaning the surface of the wire, which depend on the nature and state of the layer of dirt. In a preferred embodiment, the pretreatment begins with a cleaning that comprises a first phase of blowing with pressurized air followed by a passage through a helical comb, in both cases with the purpose of removing surface dust. After that, the wire is passed through a degreasing bath to remove any remaining oil or grease and then it is rinsed. Subsequently, it is dried by blowing with pressurized air and passing through an oven. Then the wire is introduced into a bath, which contains a product that will facilitate the adhesion of the reflective cover.

[0032] The wire is then passed through a drying oven to remove any moisture it may have carried and to set the adhesion primer layer.

[0033] The next stage is to apply the reflective cover. There are three ways to apply the reflective cover, as described below:

In a first preferred embodiment, this stage of applying the reflective cover is carried out in three steps: application of a base layer; pre-curing of the base layer; and application of reflective elements.

[0034] The first step involves applying a base coat. This first step is preferably carried out by dipping the wire into a bath containing a liquid paint or enamel, as this is the most effective method for performance, layer thickness, coating homogeneity and contamination reduction. However, this step can be carried out by application with compressed air paint guns or by extrusion.

[0035] In the second step, the base layer is pre-cured until it reaches a viscosity such that it does not hang down from the wire, remains concentric and homogeneous in thickness and allows the adhesion of the reflective optical elements. This pre-curing can be done using an oven or infrared heating lamps or in the air, depending on the method of application of the layer, the composition of the paint or enamel applied, the speed of the process and/or the length of the installation available. Specifically, this second step of pre-curing the base layer can be done in the air provided that there is sufficient distance between the paint bath of the first step and the application of the reflective elements of the third step.

[0036] In the third step, the reflective elements are applied to the previously pre-cured base layer. The reflective elements are applied by passing the wire through a fluid bed of microspheres or flakes. This procedure allows for a homogeneous application around the entire wire contour and a relatively superficial positioning of the reflective elements, which gives the wire a high reflective capacity. In another alternative implementation, the reflective elements can be applied using compressed air guns, however, this solution is considered to be less efficient.

[0037] In a second preferred embodiment, the stage of applying the reflective cover is carried out in a single step, in which the simultaneous application of a transparent paint or enamel that already includes the support and the reflective elements is carried out.

[0038] In a third preferred embodiment, the stage of applying the reflective cover is carried out in three further steps. In a first step, a base layer of white paint or enamel is applied. In the next step, the base layer is cured. In a third step, a transparent paint or enamel is applied over the previously cured base layer, which already includes the support and the reflective elements.

[0039] Following the reflective cover application stage, the reflective cover curing step is carried out until the paint or enamel has completely dried and, therefore, the reflective elements are completely fixed. This curing can be carried out using an oven, infrared heating lamps, or in the air, depending on the coating application method, the composition of the paint or enamel applied, the speed of the process and/or the length of the installation available. More specifically, this reflective cover curing stage can be carried out in the air, provided that there is enough distance between the reflective cover application stage and the following stage.

[0040] The next stage is the application of a protective layer, and although optional, it is highly recommended. The purpose of this is to cover the product with a layer of transparent lacquer that maintains the integrity of the reflective layer. This protective layer is especially important when the wire is used to manufacture fencings because during these processes the wire rubs against different surfaces (pulleys, guides, nozzles...), is twisted, knotted, etc. This is why this protective layer must facilitate the sliding of the reflective wire and prevent the microspheres from coming loose during the manufacturing processes of the different fencings types.

[0041] Preferably, this protective layer also serves as protection against atmospheric agents or against mechanical wear during transport, storage, installation and the life of the final product. In this stage of application of the protective layer, the wire is dipped in a bath containing a clear lacquer in liquid form, since this method of procedure is the most effective in terms of performance, layer thickness, homogeneity of the coating and contamination reduction. However, this stage could be carried out by application with compressed air paint guns or by extrusion.

[0042] The next stage is to cure the protective layer until the lacquer is completely dry. This curing can be done using an oven, infrared heating lamps, or in the air, depending on the method of application of the layer, the composition of the applied lacquer, the speed of the process and/or the length of the installation available. More specifically, this stage of curing the protective layer can be done in the air, provided that there is sufficient distance between the stage of application of the protective layer and the stage of winding the reflective wire.

[0043] The process ends with the winding or spooling of the reflective wire. This process can be carried out with the container in a vertical position (the container's axis in a vertical position) or horizontal (the container's axis in a horizontal position).

Claims

1. Method for obtaining a reflective wire for road safety, **characterized in that** it comprises at least the following stages:

    a) wire extraction by winding it;
    b) wire pretreatment, where the wire surface is cleaned;
    c) wire drying;
    d) application of a reflective cover;
    e) curing of the reflective cover; and
    f) winding of the reflective wire.

2. Method according to claim 1, **characterized in that** it additionally comprises a step of straightening the wire, carried out between stages a) and b).

3. Method according to claim 2, **characterized in that** the straightening step is carried out with two plates of grooved rollers, placed one after the other, and positioned so that their planes form a 90° angle.

4. Method according to claim 1, wherein the stage b) of pretreatment of the wire comprises in turn:

b1) cleaning the wire by blowing compressed air and passing the wire through a helical comb;
b2) passing the wire through a degreasing bath;
b3) drying the wire by blowing pressurized air and passing it through an oven;
b4) introducing the wire into a bath containing a product to facilitate the adhesion of the reflective cover.

5. Method according to claim 1, wherein the stage d), of applying the reflective cover, is carried out in three steps:

d1) application of a base coat;
d2) pre-curing of the base coat; and
d3) application of reflective elements.

6. Method according to claim 5, wherein the first step d1) of stage d), of applying the base coat, is carried out using compressed air paint guns, or by extrusion.

7. Method according to claim 5, wherein the second step d2) of stage d), of pre-curing the base layer, is carried out using an oven or infrared heating lamps.

8. Method according to claim 5, wherein the second step d2) of stage d), of pre-curing the base layer, is carried out in the air, provided that there is enough distance between the paint bath of the first step d1) of stage d) and the application of the reflective elements of the third step d3) of stage d).

9. Method according to claim 1, wherein the stage d), of applying the reflective cover, is carried out in a single step, in which the simultaneous application of a transparent paint or enamel is carried out that already includes the support and the reflective elements is carried out.

10. Method according to claim 1, wherein the stage d), of applying the reflective cover, is carried out in three steps:

d1') application of a base coat of white paint or enamel;
d2') curing of the base coat; and
d3') application on the previously cured base coat of a transparent paint or enamel that already covers the support and the reflective elements.

11. Method according to claim 1, wherein the stage e), of curing the reflective cover, is carried out by using an oven or infrared heating lamps.

12. Method according to claim 1, wherein the stage e) of curing the reflective cover is carried out in the air, with the condition of having enough distance between the application of the reflective cover in stage d) and the following stage.

13. Method according to claim 1, **characterized in that** following stage e) of curing the reflective cover, the method additionally comprises the following stages:

- application of a protective coating, wherein the wire is covered with a layer of transparent lacquer to maintain the integrity of the reflective layer;
- curing of the protective layer until the applied lacquer layer is completely dry.

14. Reflective wire, obtained by the process described in any one of claims 1 to 13.

15. Mesh including the reflective wire described in claim 14.

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EUROPEAN SEARCH REPORT

Application Number
EP 24 38 3038

DOCUMENTS CONSIDERED TO BE RELEVANT

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D07B
B05D
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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	26 January 2025	Flores Hokkanen, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 38 3038

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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