(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 655 533 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94308897.1**

(51) Int. Cl.[6] : **E01C 23/20**

(22) Date of filing : **30.11.94**

(30) Priority : **30.11.93 GB 9324513**

(43) Date of publication of application :
31.05.95 Bulletin 95/22

(84) Designated Contracting States :
BE DE DK ES FR GB IT NL PT SE

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(54) Profiled road markings.

(57) A method and apparatus for generating a surface profile (13) on a thermoplastic road marking (12) through the application of a profiled embossing wheel (9) to the road marking (12) is disclosed. The embossing wheel (9) is mounted a predetermined distance behind the road marking applicator (3) on a single vehicle (1) so as to allow accurate control of the time between the application of the road marking (12) and the passage of the embossing wheel (9) so as to provide consistent results tailored to the hardening time of the thermoplastic road marking (12).

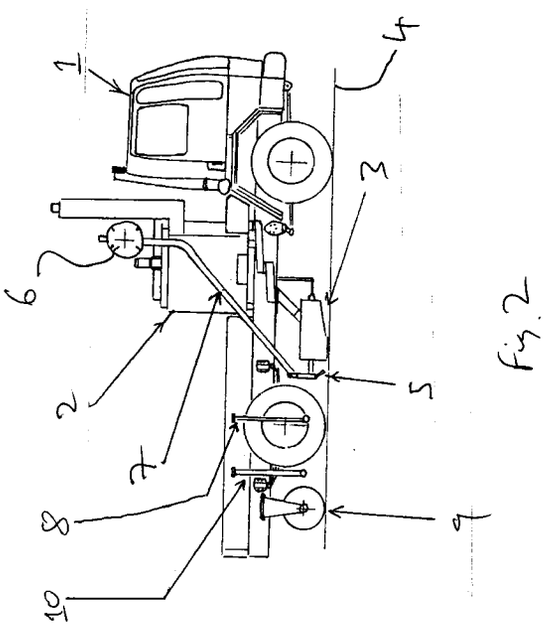

Fig. 2

EP 0 655 533 A2

This invention relates to a method and apparatus for providing a road marking, such as a centre line, which is profiled in order to provide improved wet night visibility.

Road markings such as centre lines, hazard lines and lane markings generally are based on thermoplastic materials or solvent- and water-based paints. Thermoplastic road markings have the advantage of a relatively short hardening time, and may therefore be driven over not long after being applied. This allows traffic disruption to be kept relatively low. The marking is applied by heating the thermoplastic mixture and applying it in a controlled manner onto a prepared road surface by way of a hot spray, screeding or extrusion process. In order to ensure good night visibility of the road marking, small glass beads may be mixed in with the marking mixture and/or applied to the surface of the mixture after it has been applied, but before it has hardened. These glass beads have predetermined refractive and reflective properties, and are designed to reflect light from vehicle headlamps back towards the driver. While this provides good night visibility in dry conditions, even relatively light rain can drastically reduce the visibility of the road marking by submerging the glass beads which protrude from the surface of the marking, thus altering the refractive and reflective properties of the surface as a whole.

In order to overcome this deficiency, it is known to generate a profile in the road marking as it is being laid by using a shutter-controlled screed process. By adjusting the shutter, it is possible to vary the thickness of the screeded road marking in order to produce an uneven top surface. If such a marking becomes wet, the water will tend to drain from the higher regions of the surface, exposing the glass beads located at these regions, and thereby restoring some degree of reflectivity. This shutter-controlled method, however, generates a relatively high, square-edged profile, which is unsuitable in many applications. Furthermore, the square-edged profile presents only one face to oncoming traffic, which limits the direction in which the glass beads reflect.

It is also known, from EP 0 124 946 (Moses Bollag), to apply a profile to a paint-based road marking after it has been applied. This is done by first applying a stretch of paint-based road marking, and subsequently rolling a profiled rubber tyre along the road marking, after it has been laid but before the paint has dried. EP 0 124 946 teaches that it is impracticable and irrational to use this method with a thermoplastic road marking mixture because such mixtures harden before there is time to apply a profile. EP 0 124 946 also teaches that it would not be possible to apply and profile a thermoplastic road marking as a continuous process, since it is not possible to arrange for the extrusion device and the profiling device to progress at the same rate over a reasonable distance. Consequently, problems arise if the profiling device starts to lag behind the extrusion device, since the thermoplastic marking material will have hardened by the time it is reached by the profiling device.

According to a first aspect of the present invention, there is provided a method of generating a surface profile on a thermoplastic road marking, wherein a profiled embossing wheel is rolled along the road marking after the road marking has been applied but before the road marking has hardened in order to generate a complementary surface profile on the road marking.

According to a second aspect of the present invention, there is provided a method of generating a surface profile on a thermoplastic road marking, wherein, a predetermined time after the road marking has been applied but before it has hardened, a profiled embossing wheel is rolled along the road marking in order to generate a complementary surface profile on the road marking.

According to a third aspect of the present invention, there is provided a road marking apparatus comprising application means for applying a thermoplastic road marking to a road surface and a profiled embossing wheel for generating a complementary surface profile on the road marking, wherein the embossing wheel is disposed at a predetermined location behind the application means.

Through the use of an embossing process to apply a profile to the road marking, the resultant profile may take a much greater variety of patterns than are possible to apply using a shutter-screeding process. In particular, the profile applied using a profiled embossing wheel may be rounded, which allows the profile to present a multitude of faces to oncoming traffic, thereby enhancing the reflectivity of the road marking.

Advantageously, the thermoplastic road marking is a hot-applied product, 100% solids-based, and comprises a thermoplastic resin binder which may be plasticised and modified with predetermined polymeric additives. The binder may also contain one or more of pigment, extender, reflective glass beads and aggregate. In order to regulate the flow characteristics of the thermoplastic road marking during application, it may also contain additives to control melt flow behaviour and thixotropic properties.

The thermoplastic road marking, generally supplied from a boiler mounted on the applicator vehicle, is first applied to the road surface to a thickness of 1 to 10mm, and preferably to a thickness of 2 to 5mm. The method of application may comprise a hot spray, a screeding or an extrusion process.

Advantageously, the embossing wheel and the application means are located on a single applicator vehicle. This allows the embossing wheel to follow the application means at a predetermined distance. In a preferred embodiment, the distance of the embossing

wheel from the application means is adjustable, which allows the system to be tailored to the hardening characteristics of different thermoplastic road markings. The system may be further tailored to individual hardening characteristics through the provision of a speed control mechanism in the applicator vehicle.

In preferred embodiments of the present invention, a coolant, for example water or air, is applied to the thermoplastic road marking after it has been laid and before it has been profiled. Good control of cooling is important in achieving the correct profile and cooling rates. The hardening characteristics of the thermoplastic road marking may be further controlled by regulating the application of coolant. Coolant may also be applied to the embossing wheel in order to reduce adhesion to the road marking. Further coolant may be applied after the road marking has been profiled in order to ensure that it has hardened sufficiently to enable early opening of the road to traffic, particularly in conditions of high ambient temperature. At an ambient temperature of 20°C, the hardening time of a thermoplastic road marking cooled in this way can be as little as one minute. The coolant is advantageously applied by way of spray bars mounted on the applicator vehicle.

In preferred embodiments, the applicator vehicle is also provided with a reflective glass bead applicator. Reflective beads may then be applied to the surface of the thermoplastic road marking after it has been laid, either before or after the passage of the embossing wheel. Where reflective beads are applied before the passage of the embossing wheel, the wheel has the advantageous effect of pushing the beads at least some way into the surface of the road marking, thereby providing improved embedment and retention of the beads under traffic.

In preferred embodiments of the present invention, the embossing wheel is made out of metal into which the required profile has been cut. Suitable metals include mild steels, stainless steel and aluminium, although other metals may be found to be satisfactory. Alternatively, the embossing wheel may comprise a metal inner provided with a profiled tyre made out of rubber, such as silicon rubber, or out of a synthetic polymer. The width of the wheel is generally somewhat greater than the width of the profiled thermoplastic road marking in order to keep the embossing wheel in contact with the road marking even when the applicator vehicle is driving through a bend. Typically, the width of the embossing wheel is around 20cm, but may be from 5cm up to 50cm or even wider for certain applications. The embossing wheel is preferably mounted on the applicator vehicle in a resilient manner so as to apply enough pressure to the thermoplastic road marking to ensure that the surface is adequately profiled.

Advantageously, the mounting is adjustably resilient in order to allow varying degrees of profiling. In one embodiment, the embossing wheel may be located or mounted on a linkage, such as a "universal joint", which enables correct orientation of the wheel on the road marking even though the applicator vehicle may move about due to crossfalls or deformations in the road surface. The linkage may either be passive or active. In the latter case, a computer-controlled mechanism is provided which actively keeps the embossing wheel in the correct orientation by way of servo control in response to the movement of the applicator vehicle.

The pattern on the embossing surface of the embossing wheel may take any suitable form, and the embossing wheel may be releasably mounted in order to allow different embossing wheels to be used in different applications. The depth of the profile is typically around 5mm, but may be from 2mm up to 10mm or even deeper for particular applications. Generally, the profile is cut into the surface of the embossing wheel, but in certain applications the profile may project from the surface of the wheel. In certain embodiments of the present invention, the embossing wheel may be provided with one or more coolant channels through which coolant may pass.

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

FIGURE 1 shows an applicator vehicle from the front;

FIGURE 2 shows the applicator vehicle of Figure 1 from the side;

FIGURES 3 to 7 show various embossing wheels;

FIGURE 8 shows a side view of a thermoplastic road marking after the passage of an embossing wheel; and

FIGURE 9 shows a plan view of the thermoplastic road marking of Figure 8.

The applicator vehicle 1 of Figures 1 and 2 carries a supply of thermoplastic road marking material in a boiler 2. Connected to the boiler 2, and mounted to one side of the applicator vehicle 1 is an applicator box 3. When the road marking is being applied, the applicator vehicle 1 moves forward and the road marking material (not shown) is applied to the road surface 4 by the applicator box 3. Reflective glass beads (not shown) are then applied by an applicator 5, which is supplied from a vessel 6 via a delivery tube 7. The road marking is then cooled through the application of coolant via spray bar 8. The embossing wheel 9, which is cooled by coolant supplied through spray bar 10, then passes over the still plastic road marking and embosses a predetermined profile into the road marking surface.

Figures 3 to 7 show an embossing wheel 9 made out of mild steel with various profile patterns 11 cut into its surface. The profile patterns 11 are around

5mm deep.

Figure 8 shows a thermoplastic road marking 12 which has been profiled by an embossing wheel 9' which is provided with a gearwheel profile 11'. The resulting profile 13 of the road marking 12 is complementary to the profile 11' of the embossing wheel 9'. Figure 9 is a plan view of the road marking 12, and shows the profile 13 extending across the width of the road marking.

Claims

1. A method of generating a surface profile on a thermoplastic road marking (12), wherein, a predetermined time after the road marking (12) has been applied but before it has hardened, a profiled embossing wheel (9) is rolled along the road marking (12) in order to generate a complementary surface profile (13) on the road marking (12).

2. A method according to claim 1, wherein a coolant is applied to the road marking (12) after it has been laid and before passage of the embossing wheel (9).

3. A method according to claim 1 or 2, wherein a coolant is applied to or through the embossing wheel (9).

4. A method according to claim 1, 2 or 3, wherein reflective glass beads are applied to the road marking (12) before passage of the embossing wheel (9) so that the embossing wheel (9) at least partly pushes the glass beads into the road marking (12).

5. A road marking apparatus comprising application means (3) for applying a thermoplastic road marking (12) to a road surface (4) and a profiled embossing wheel (9) for generating a complementary surface profile (13) on the road marking (12), wherein the embossing wheel (9) is disposed at a predetermined location behind the application means (3).

6. An apparatus as claimed in claim 5, wherein the embossing wheel (9) is resiliently mounted on the apparatus.

7. An apparatus as claimed in claim 5 or 6, wherein the embossing wheel (9) is mounted on the apparatus by way of a joint which allows the embossing wheel (9) to maintain its orientation with respect to the road surface (4) regardless of the relative orientation, within predetermined limits, of the main body (1) of the apparatus.

8. An apparatus as claimed in claim 5, 6 or 7, wherein the embossing wheel (9) is provided with one or more coolant channels.

9. An apparatus as claimed in any of claims 5 to 8, wherein the embossing wheel (9) is releasably mounted on the apparatus.

10. An apparatus as claimed in any of claims 5 to 9, wherein the apparatus is arranged so that the width of the embossing wheel (9) is greater than the width of the thermoplastic road marking (12) to which the surface profile (13) is applied.

Prismo

ROAD MARKING APPLICATOR - GENERAL ARRANGEMENT

SYSTEM 2 PROFILED FINISH

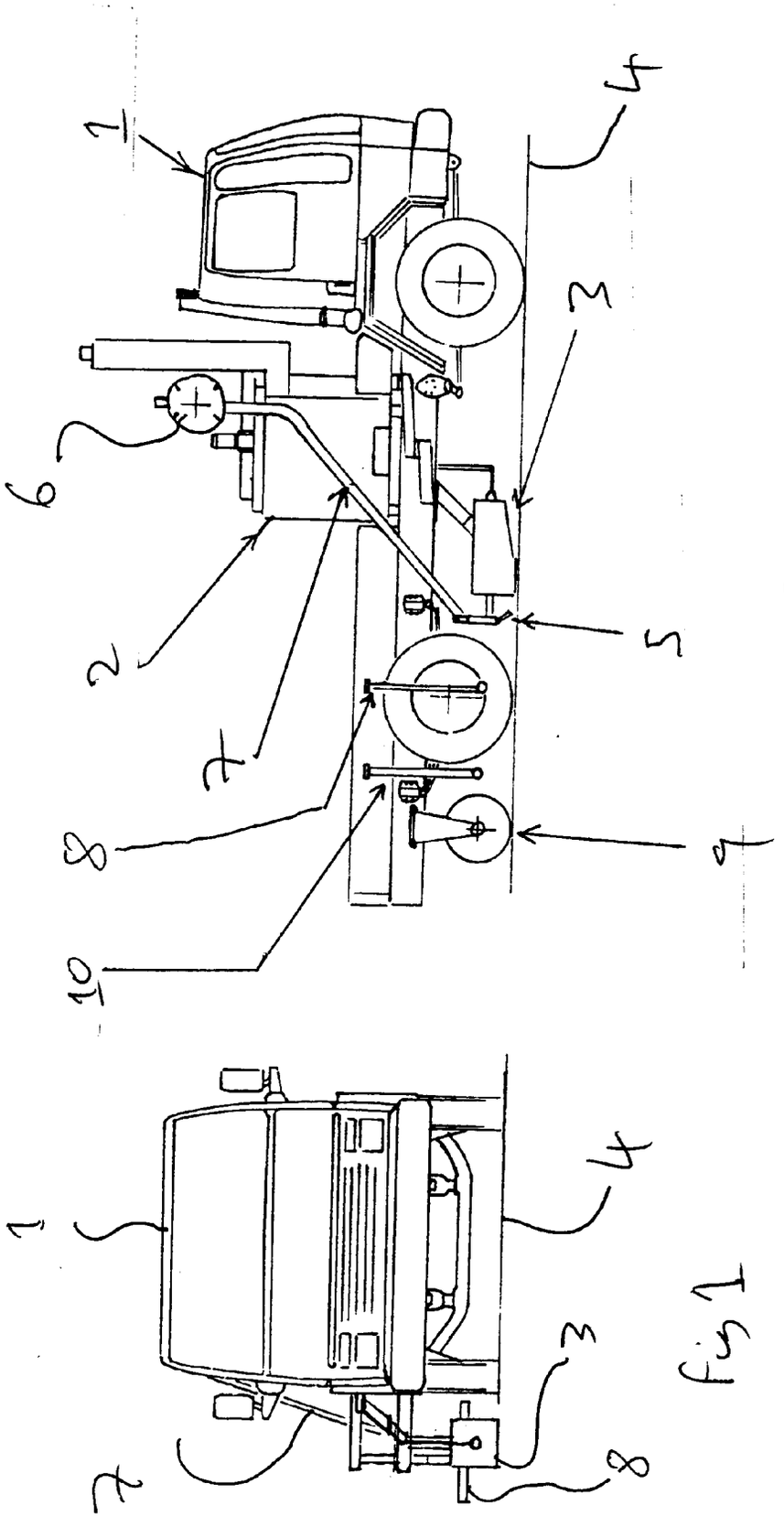

Fig. 2

Fig 1

Prismo

ROAD MARKING EMBOSSING WHEEL - VARIOUS PATTERNS

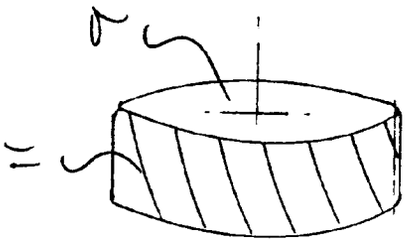

Fig 7

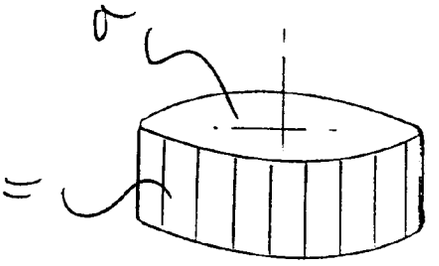

Fig 6

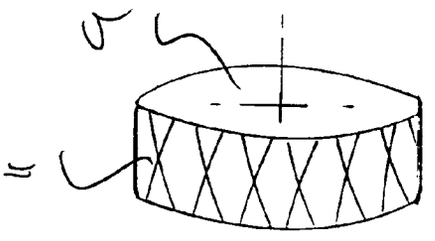

Fig 5

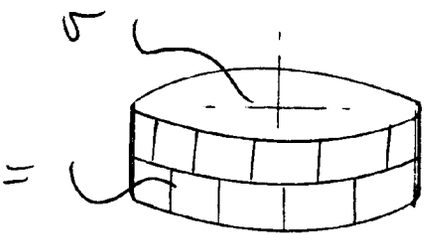

Fig 4

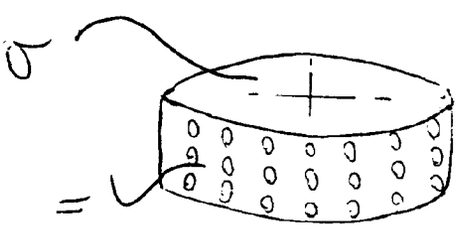

Fig 3

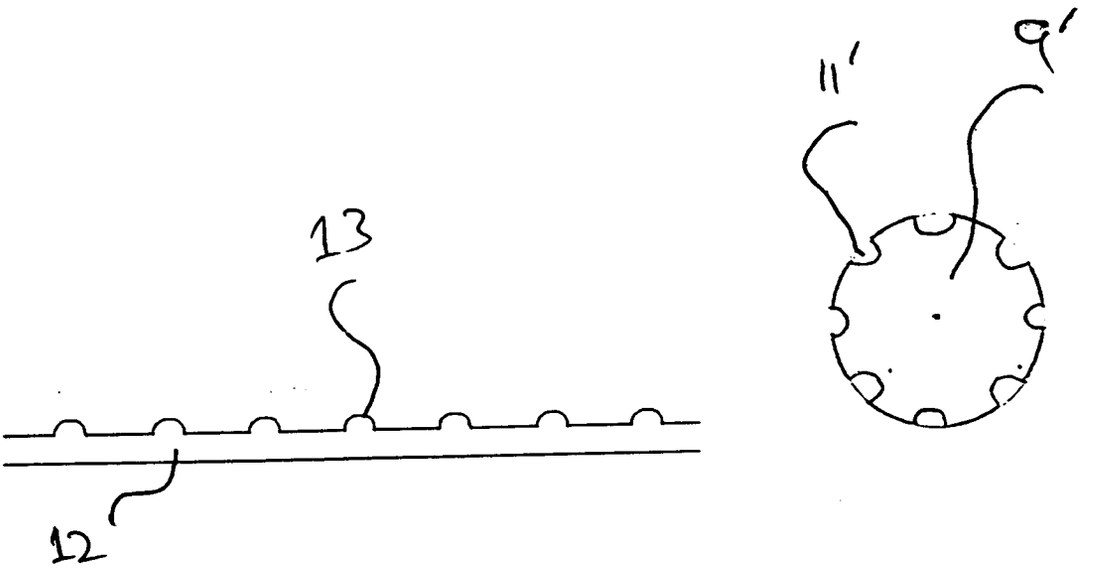

fig 8

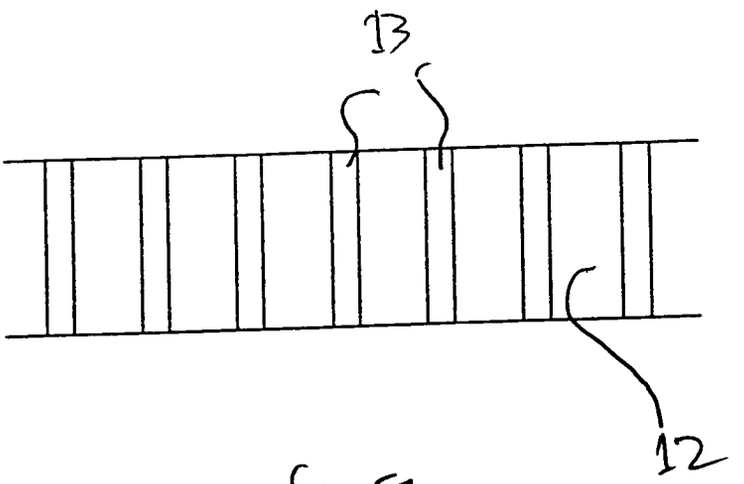

fig 9