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Cycle ruler or cycle disc**Description**

The invention relates to a cycle ruler or cycle disc consisting of a transparent carrier provided with a light-sensitive film layer which comprises a plurality of bar codes blackened by light exposure and transparent window openings for being scanned by optical sensors, and a reflective layer. The invention also relates to a method of producing such a cycle ruler or cycle disc of the initially mentioned type.

Cycle rulers and cycle discs serve to record the position of operating machines, manipulators or other setting devices. They consist of a transparent material containing codes which are scanned by optical sensors.

As a rule, cycle discs are fixed on a rotating axle by means of a hub. By applying a light transmission method, a ray of light generates pulses while the disc is rotating. The light source is positioned parallel to the axis of rotation and sends a ray of light to the disc at a right angle.

It is advisable for the transparent material, on the side facing away from the transmitter, to be provided with a reflective material, so that the light rays emitted from the transmitter can be reflected in the optical axis and recorded by the receiver. The length and frequency of the pulses is determined by so-called window openings

which are predetermined when arranging the bar codes on the cycle ruler, thus coding the cycle ruler into "transparent and lightproof regions". The codings for the cycle rulers have to be produced with a high degree of accuracy to ensure that the positions of the moved machine parts are determined accurately.

For producing cycle rulers or cycle discs it is advantageous to use industrial film which is exposed to light by using masks or a photoplotter and which, after having been developed, comprises blackened codings, so-called bar codes. At the "window openings", the exposed and developed standard film is transparent and the codings exist of black and non-reflective silver grains which are embedded in gelatine.

After the film has been exposed, developed and rinsed, the code marks are arranged in the form of raised portions on the carrier layer at predetermined distances. After careful examination it was found that between the raised portions, there still remained a residue of gelatine which, in spite of a careful development process and multiple rinsing, could not be removed fully.

On to this surface there is applied a reflective layer by steaming same on or by other thin film methods. However, said reflective layer is not humidity-proof so that, in order to improve the corrosion behaviour, it was necessary to apply a water vapour blocking layer.

For production-technical reasons, cycle rulers and cycle discs are produced on large-surface carrier materials and divided into individual parts by punching or cutting. At the resulting cutting edges, the individual layers are unprotected and exposed to the environment. The humidity penetrating into the layer of gelatine blows up the composite and deforms the reflective layer, thus

adversely affecting the measuring accuracy.

It is therefore the object of the invention to develop a cycle ruler or cycle disc which does not suffer from the above-described disadvantages and which retains a high degree of dimensional accuracy over a longer period of service.

In accordance with the invention, the objective is achieved by the characteristics of claims 1 to 6. It has been found that by arranging the code marks in the edge regions of the cycle disc and cycle ruler, humidity has, without fail, been prevented from entering the gelatine containing regions.

Below, the invention will be explained in greater detail with reference to several embodiments illustrated in the drawing wherein

Fig. 1 is a cross-section through a cycle ruler in accordance with the invention.

Fig. 2 is a plan view and a cross-section of an inventive cycle disc.

Fig. 3 is a plan view of an inventive cycle ruler.

In Figure 1, the carrier 1 consists of a transparent material, for example a polyester material which is connected to an upper and a lower gelatine layer 13, 14 by means of an adhesive layer 12.

On the side which, according to the view shown in Fig. 1, is the lower side, the region of the gelatine layer 14 is provided with bar codes 3, 4, 5, 10, 15 which, after exposure of the light-sensitive layer 2, have been produced by blackening the silver grains in the gelatine layer.

After the exposed, silver-grain-containing gelatine layer has been rinsed, there remains residual gelatine 14 between the code marks 3, 4, 5, 10, 15, which region, by means of a thin film process, is covered by a reflective layer 8, with a protective layer 11 being applied thereafter.

Figure 2 shows an alternative illustration of the invention in the form of a cycle disc 16. The member 17 comprises a flange face and a centric hub 18 on which the cycle disc is centred by means of its central opening 19.

The cycle disc design is analogous to that shown in Fig. 1, but instead of having a protective layer 11, the member 17 is connected to the reflective layer 8 by an adhesive layer 20.

The inner and outer rims of the cycle disc are provided with annular or bead-shaped bar codes 21a, b which are blackened throughout and form the end edges of the cycle disc.

Figure 3 shows a cycle ruler in the form of a plan view and cross-section, with the material being built up analogously to the alternative illustrated in Figure 1. Instead of the protective layer 11 according to Figure 1, Figure 3 shows a rectangular carrier 22 which is connected to the reflective cycle ruler 24 by means of an adhesive layer 23.

The edge of the cycle ruler is formed by continuous bar codes which, in the outer region, are provided in the form of a rectangular code bar 25 and at the fixing bores 26, 27 in the form of annular or bead-shaped edges 28, 29.



Claims

1. A cycle ruler or cycle disc consisting of a transparent carrier (1) provided with a light-sensitive film layer (2) which comprises a plurality of bar codes blackened by light exposure, with transparent window openings (6, 7) arranged therebetween, for being scanned by optical sensors, and further comprising a reflective layer (8),

characterised in

that the light-sensitive layer in the edge region (9) of the cycle ruler or cycle disc consists of a continuous bar code (10) and that the reflective layer (8) is provided with a cover which covers the bar codes and the window openings completely as far as and including the edge region.

2. A cycle ruler or cycle disc according to claim 1,

characterised in

that the cover consists of a protective layer (11) adhering to the reflective layer (8).



3. A cycle ruler or cycle disc according to any one of the preceding claims,

characterised in

that the cover consists of a varnish.

4. A cycle ruler or cycle disc according to any one of the preceding claims,

characterised in

that the cover consists of a firm carrier material and that the spaces between the bar codes, the window openings and the edge regions are completely filled with a glue or adhesion promoter.

5. A cycle ruler or cycle disc according to any one of the preceding claims,

characterised in

that the bar codes (3, 4, 5 and 10) are arranged in the form of raised portions on the cycle disc or cycle ruler and that the continuous bar code (10) forms the outer and/or inner edge of the cycle ruler or cycle disc.

6. A method of producing a cycle ruler or cycle disc consisting of a material according to one of the preceding claims,



characterised in

that, after having been exposed to light, the light-sensitive layer comprises a bar code which extends continuously around the edge and which, after having been fixed, is rinsed to remove the gelatine layers surrounding same, and that a reflective layer and cover are applied to the developed and rinsed carrier and that thereafter, the cycle ruler or cycle disc is separated or cut off along the continuous bar code.

7. A method according to claim 6,

characterised in

that the cover is applied over a glue or adhesion promoter so as to extend over the entire surface as far as the edge region of the cycle ruler or cycle disc.

8. A method according to any one of the preceding claims,

characterised in

that an opening is centrically punched into the cycle disc to allow same to be fixed on a hub, with the cutting edge for the aperture rim being arranged on an annular bar code extending coaxially relative to the hub aperture.