(54) Title: PROCESS AND EQUIPMENT FOR DECORATING OBJECTS WITH LIQUID PAINTS OR INKS

Fig.1

(57) Abstract: A method for decorating objects such as metal section bars provides in sequence the following steps: - loading the objects (11) on a conveyor (14) in a loading station (12); - conveying the objects (11) to a decorating station (18); - applying, with a plotter device (19) provided with controlled-jet heads, on one side of the object (11) facing towards the plotter and previously painted with base powders, a decoration using liquid paints or inks; - performing a first fixning of the decoration by drying said paints or inks; - conveying the decorated objects (11) to a polymerization station (23); - performing a final hot polymerization of the decoration, thereby obtaining finished objects (11) with a stable bound between the base powders and the paints or inks used for decoration; - conveying the finished objects (11) to an unloading station (25); - unloading the objects (11) from the conveyor (14).
PROCESS AND EQUIPMENT FOR DECORATING OBJECTS WITH LIQUID PAINTS OR INKS

The present invention relates to a process and equipment for decorating objects, in particular metal section bars, with liquid paints or inks. In the field of metal section bars it is known to treat the section bars by painting processes with thermosetting powders.

An example of treatment of section bars by applying successive even layers of paint is described in the international patent application WO-A-01/83119. For a few years the market has been requiring such painted metal section bars to be also decorated with a surface finish that makes the surface aesthetically similar to wood.

By the term "decoration" in the present description it is meant the make of a predetermined drawing or pattern on the (already painted) surface of the section bar for changing the evenness of the base paint layer as desired.

The two operations of painting and decoration are substantially carried out in two successive steps and in two different plants.

The current mostly used decoration techniques may be substantially divided into two groups:

a) decoration by sublimation;

b) so-called "powder on powder" decoration.

In order to use the decoration technique by sublimation, the metal section bars must first be painted, in known painting plants, with thermosetting powders adapted to thereafter withstand the sublimation
temperature of the inks used for the decoration. The powder polymerization must be complete.

The painted section bars then move to the sublimation plant, where they are coated with special inked films carrying the pattern to be reproduced.

The film, kept in contact with the painted surface of the section bar, is subject to heating. At a predetermined temperature (usually about 190°C), the inks present on the film sublimate and transfer the pattern into the base paint. This system generates high quality decorations but the process cost is high as it requires much labour and expensive raw materials.

Using the "powder on powder" decoration technique, the section bars are painted in a known powder painting plant, however the powder does not undergo a complete polymerization. The baking oven is in fact kept at a relatively low temperature (120-130°C) in order to carry out a partial polymerization of the base powder.

The section bars are then moved to a decorating plant where, using silk screen printing frames or engraved mats, a second powder is deposited onto the section bars to make the desired decoration. Also the second powder undergoes a partial polymerization in order to allow the section bars to be manipulated.

The decorated section bars with the partially polymerized paint must go into an oven again in order to obtain the complete polymerization of the two powders.

Examples of these "powder on powder" decoration systems are described in the international application WO-A-2004/098786 and in the European application EP-A-1518609.
This system requires a low cost of raw materials but a high labour cost. Moreover, the process is very long since the operation (deposition of the second powder and partial polymerization thereof) must clearly be separately repeated for each side of the section bar to be decorated.

The aesthetic quality of the surface finish is in any case poor and considerably lower than that obtained through sublimation.

A further and more complex decoration system is known, for example, from the European application EP-A-2 016 660, where the section bars are coated with a base layer of powder paint that is hardened by heating at 180°C, a decoration is applied thereafter by ink jet, which is in turn coated with a protective paint layer, and finally the paints and the applied decoration are subject together to a "flash U.V." polymerization treatment by a fraction of a second at room temperature (15-25 °C) under a U.V. lamp.

With the section bar painting and decoration techniques used so far, therefore, the costs of labour, energy and raw materials are very high.

The general object of the present invention is to obviate the prior art drawbacks and meet the new market requirements.

In particular, it is an object of the present invention to reduce the labour required, reduce energy consumption, reduce the environmental pollution and the overall process costs.

In view of such object, a method has been devised according to the invention for decorating objects such as metal section bars, which provides in sequence the
following steps:
- loading the objects on a conveyor in a loading station;
- conveying the objects to a decorating station;
- applying, with a plotter device provided with controlled-jet heads, on one side of the object facing towards the plotter and previously painted with base powders, a decoration using liquid paints or inks;
- performing a first fixing of the decoration by drying said paints or inks;
- conveying the decorated objects to a polymerization station;
- performing a final hot polymerization of the decoration, thereby obtaining finished objects with a stable bound between the base powders and the paints or inks used for decoration;
- conveying the finished objects to an unloading station;
- unloading the objects from the conveyor.

According to the invention, moreover, an equipment has been devised for decoration, by means of liquid paints or inks, of objects such as metal section bars, previously painted with base powders, comprising a loading station for the objects to be decorated, an unloading station for the decorated objects, a conveyor for conveying the objects between the loading station and the unloading station, a decorating station placed downstream of the loading station and provided with a plotter device equipped with controlled-jet heads for applying liquid paints or inks on the surfaces of the objects to be decorated and with drying devices for drying the liquid paints or inks applied by the plotter.
device, a polymerization station placed downstream of the decorating station for the final hot polymerization of the painting with base powders and of the decoration.

To make the description of the innovative principles of the present invention and the advantages thereof with respect to the prior art clearer, a possible exemplary embodiment applying such principles is described hereinafter with reference to the annexed drawings. In such drawings:

- Figure 1 shows a schematic partial section side elevation view of a plant adapted to carry out the process of decoration of section bars according to the invention;

- Figure 2 shows a schematic plan view of the equipment of Figure 1.

In the figures, reference numeral 10 generically indicates a plant or equipment adapted to carry out a decoration treatment on a plurality of objects 11, in particular metal section bars.

Equipment 10 comprises a loading station 12 where the section bars 11, previously painted with base powders in a painting plant according to known techniques (for example by subjecting the painted section bars to a thermal treatment at about 120-130°C for fixing the powders so as to not damage the base paint during the subsequent piece manipulation), are loaded onto a conveying line 13. As an alternative, the application and the treatment of the base powders might be carried out on the section bars along the plant line, prior to the decorating station.

The conveying line described and illustrated herein
advantageously consists of a closed ring conveyor 14, a solution that allows the space occupied by the plant to be optimized.

In particular, the conveyor 14 is of the type with parallel chains 15, 16, whereon the section bars 11 are supported into groups for being advanced step by step along the various processing stations provided along the conveying line.

Advantageously, the section bars 11 are supported at their ends to the chains by means of clamping devices 17 provided with a system for tensioning and rotation. Such devices are only schematically shown in Figure 2, since they may be of any suitable type well known to the man skilled in the art.

Once loaded onto conveyor 14, the group of section bars 11 is conveyed to a decorating station 18 provided with a device for positioning the section bars flat, schematically shown in Figure 1.

The decorating station 18 comprises a plotter device 19 provided with controlled-jet heads for the application of liquid paints or inks onto the surfaces, previously painted with base powders, of section bars 11 according to a predetermined pattern intended to form the surface decoration of the section bar, or in any case of the object subject to treatment.

As is clear to the man skilled in the art, the plotter allows a specific drawing or pattern to be reproduced (by the control of dedicated computer programs) which is very different from the even spraying obtained by means of a common painting head.

The plotter device 19 is movable relative to the group of section bars present into the decorating station 18,
along the direction shown by arrow 20 in Figure 2, crosswise the moving direction of conveyor 14. In Figure 2, the plotter is shown with a solid line in one of the two limit positions on one side of the conveyor in the decorating station, and with a dashed line in the other limit position on the opposite side of the conveyor.

During the stroke between the two limit positions above, the plotter device 19 substantially moves at a fixed distance from the surface of the section bars facing towards the controlled-jet heads thereof, so that the liquid paint or ink dispensed thereby may be applied on the side of the section bars facing towards the plotter.

The decorating station 18 also comprises means for the quick drying of the liquid paint or ink applied by the plotter. In the described embodiment, the drying means comprise drying devices 21, 22 arranged, as is well visible in Figure 2, on the two opposite sides of the plotter device 19 relative to the moving direction of the same plotter. Advantageously, the drying devices 21, 22 are arranged on the support and handling carriage of the plotter.

The drying devices 21, 22 are adapted to carry out a first fixing of the decoration substantially at room temperature, for example with ultraviolet, infrared or microwave action. According to a preferred operating method, the drying of the liquid paint or ink takes place during the same stroke of the plotter with which the decoration is applied. To this end, it is possible to use the drying device mounted behind plotter 19 relative to the
feeding direction of the latter, that is, the drying device 21 during the plotter stroke from the position shown with a solid line in Figure 2 towards the position shown with a dashed line and the drying device 22 during the reverse stroke.

As an alternative, the application of the liquid paint or ink may be carried out during the forward stroke of the plotter device and the drying during the return stroke.

If it is required to decorate multiple sides of each section bar, at the end of the application and drying steps of the liquid paint or ink on the side initially facing towards the plotter, the section bars may be rotated in the decorating station by means of the tensioning and rotation system the devices 17 for clamping the section bars to the chains of conveyor 14 are provided with.

After said rotation, a new side of the section bars faces the plotter, ready to be decorated repeating the steps of application and subsequent drying of the liquid paint or ink described above for the first side. This may be repeated until all the sides of the section bars have been decorated.

A different decoration may of course be applied on each side of each section bar, if desired, since the dispensing of the liquid paint or ink by the controlled-jet heads may be managed with dedicated computer programs, made and selected according to the needs.

Once the required decoration has been completed in the decorating station 18, the decorated section bars are conveyed by means of conveyor 14 to a polymerization
station 23. The polymerization station 23 comprises an oven 24 which is passed through by the conveying line 13.

In the oven 24, advantageously of the hot air type, the base paint and the decoration are subject to a final hot polymerization step (at a temperature in the range between 160°C and 200°C), whereby finished objects are obtained having a stable bond between the base powders and the paints or inks used for the decoration.

Thanks to the concurrent polymerization of the base powders and of the liquid paints or inks used for the decoration it is possible to obtain an even layer with a high weather resistance. Once the final polymerization has been carried out, the section bars are conveyed along the conveying line 13 to an unloading station 25, where they are unloaded from conveyor 14.

In the embodiment shown, the unloading station 25 is arranged in the same zone of the plant where the loading station 12 is located. Advantageously, the loading and unloading stations may be part of the same structure, schematically shown in the figures.

It is now clear that the intended objects are achieved. In particular, it is possible to reduce energy consumption and labour, especially if automated means for loading and unloading the section bars are used. Moreover, thanks to the possibility of managing the step of dispensing the liquid paints or inks by the plotter by means of computer programs, it is possible to easily make different decorations on the various section bar faces.

Of course, the above description of an embodiment
applying the innovative principles of the present invention is given by way of an example of such innovative principles and should not therefore be taken as a limitation to the intellectual property scope claimed herein.

For example, the section bar decoration equipment described herein of the closed ring parallel chains type may also be designed according to other configurations capable of carrying out the sequence of operations according to the present invention. In particular, the section bar conveying line may be of the open type, which extends from a loading station and an unloading station arranged in different points of the equipment.

Moreover, the loading and unloading of the section bars in stations 12, 25 may be carried out manually or automatically.
CLAIMS

1. A method for decorating objects such as metal section bars, providing in sequence the following steps:

- loading the objects (11) on a conveyor (14) in a loading station (12);
- conveying the objects (11) to a decorating station (18);
- applying, with a plotter device (19) provided with controlled-jet heads, on one side of the object (11) facing towards the plotter and previously painted with base powders, a decoration using liquid paints or inks;
- performing a first fixing of the decoration by drying said paints or inks;
- conveying the decorated objects (11) to a polymerization station (23);
- performing a final hot polymerization of the decoration, thereby obtaining finished objects (11) with a stable bound between the base powders and the paints or inks used for decoration;
- conveying the finished objects (11) to an unloading station (25);
- unloading the objects (11) from the conveyor (14).

2. The method according to claim 1, characterized in that, after having performed the decorating step and the step of first fixing of the decoration, the objects (11) in the decorating station (18) are rotated in order to have another side facing towards the plotter, so repeating the decorating step and the step of first fixing of the
3. The method according to claim 2, characterized in that the object rotating step and the steps of decoration and first fixing of the decoration are repeated until all the sides of the objects (11) have been decorated.

4. The method according to claim 3, characterized in that a different decoration is applied on each side of the objects (11).

5. The method according to claim 1, characterized in that for the application of the decoration, the plotter device (19) is moved, with respect to the objects (11) in the decorating station (18), transversally to the moving direction of the conveyor (14).

6. The method according to claim 1, characterized in that the drying of paints or inks for the first fixing of the decoration is made at room temperature.

7. The method according to claim 5, characterized in that the steps of decoration and first fixing of the decoration are made during the same stroke of the plotter device (19).

8. The method according to claim 1, characterized in that the final polymerization in the polymerization station (23) is made in an oven (24) at a temperature comprised between 160°C and 200°C.

9. An equipment for decoration, by means of liquid paints or inks, of objects (11) such as metal section bars, previously painted with base powders, comprising a loading station (12) for the decoration on such other side.
objects to be decorated, an unloading station (25) for the decorated objects, a conveyor (14) for conveying the objects (11) between the loading station and the unloading station, a decorating station (18) placed downstream of the loading station (12) and provided with a plotter device (19) equipped with controlled-jet heads for applying liquid paints or inks on the surfaces of the objects to be decorated and with drying devices (21, 22) for drying the liquid paints or inks applied by the plotter device (19), a polymerization station (23) placed downstream of the decorating station (18) for the final hot polymerization of the painting with base powders and of the decoration.

10. The equipment according to claim 9, characterized in that the plotter device (19) is movable, with respect to the objects (11) present in the decorating station (18), transversally to the moving direction of the conveyor (14).

11. The equipment according to claim 10, characterized in that the drying devices (21, 22) are jointly movable with the plotter device (19).

12. The equipment according to claim 9, characterized in that the conveyor (14) is of the type with parallel chains (15, 16), on which the objects (11) are supported at their ends by means of clamping devices (17) provided with a system for tensioning and rotation of the objects.