

APPARATUS FOR CURING A COATING MATERIAL FOR MARKING ON CONTINUOUS WEB

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus for curing a coating material for marking which is applied to welded or defected areas of a strip or web of a metal such as brass, phosphor bronze, stainless steel, cupronickel, pure copper or its plated metal.

2. Description of the Related Art

Metal webs that are in the form of thin band are welded to each other so that they continuously extend in a longitudinal direction. Then, they are wound on a bobbin to form winding (includes the multi coil) and are shipped from a factory. In a purchaser's factory, the wound webs are unwound to manufacture reed frames or connector terminals. At that time, welded or defected areas are detected by a sensor so that the areas to be used for the reed frames or connector terminals will not include such welded or defected areas.

A coating material has previously been applied on the welded or defected areas of the continuous web for marking them in factories where continuous webs are manufactured and the applied coating material has been dried by a specialized apparatus for drying coating material for marking. Figs. 6 and 7 illustrate conventional typical apparatus for drying a coating material for marking which are small manual type and large automatic opening type, respectively.

Referring now to Fig. 6, an apparatus for drying a coating material for marking of manual type 50 includes a lower case 52 having a drying chamber 52a in the center thereof and an upper case 54 which is hinged to the lower case 52. The shapes of the lower and upper cases 52 and 54 in plan view are shown in Fig. 6(b). A relatively long area of the continuous web 2 remains in the drying chamber 52a.

The lower case 52 is provided on its two sides with mounting openings 52b on which hot air generators (industrial drier) 52e are mounted. Hot air which has entered into the drying chamber 52a is externally discharged through a respective gap formed at an inlet 52c and outlet 52d of the apparatus 50 for drying the continuous web 2.

When the continuous web 2 is loaded on the drying apparatus 50, the upper case 54 is opened by gripping a handle 54a provided on the upper case 54 and the continuous web 2 is passed through the inlet 52c and the outlet 52d so that it is placed on the lower case 52. After the upper case 54 is closed, hot air is blown

into the drying chamber 52a from the hot air generators 52e. After the lapse of a predetermined period of time, air of room temperature is fed to the drying chamber 52a from the hot air generators 52e by switching the hot air blowing mode to air blowing mode. After the lapse of a given period of time, the upper case 54 is opened to remove the continuous web 2 from the drying apparatus 50. The drying apparatus 50 is removed from the production line by an operator while traverse winding and coil winding of the continuous web is continued.

Referring now to Fig. 7, the automatic operable type apparatus for drying a coating material for marking 60 comprises a stand 61 which is reciprocally disposed on a floor 1, a pair of upper and lower horizontal support members 63, 65, and actuators 66 disposed on faces opposite to the pair of horizontal support members 63, 65. The lower and upper cases 62 and 64 are supported by the actuators 66 disposed on the pair of horizontal support member 63, 65, respectively, so that the cases are reciprocal in a vertical direction. The lower and upper cases 62 and 64 are provided on their inner sides with drying chambers 62a and 64a. The lower case 62 is provided on one side with a mounting opening 62b thereof on which a hot air generator 62e is mounted. The upper case 64 is provided on one side thereof with a mounting opening 64b on which a hot air generator 64e is mounted.

The hot air that has entered into the drying chambers 62a and 64a is externally discharged via gaps that are formed between the inlets 62c and 64c and between the outlets 62d and 64d.

When the continuous web 2 is loaded on the drying apparatus 60, the upper and lower cases 62 and 64 are opened by operating the actuator 66 and the continuous web 2 is then passed through the inlet 62c and the outlet 62d of the lower case 62 so that it is placed on the lower case 62. After the upper case 64 is closed, hot air is blown into the drying chambers 62a, 64a from the hot air generators 62e, 64e. After the lapse of a predetermined period of time, air of room temperature is fed into the drying chambers 62a, 64a from the hot air generators 62e, 64e by switching the hot air blowing mode to atmosphere blowing mode. After the lapse of a given period of time, the lower and upper cases 62 and 64 are opened by operating the actuator 66 to remove the continuous web 2 from the drying apparatus 60. The drying apparatus 60 is removed from the production line by an operator while traverse winding and coil winding of the continuous web 2 is continued.

In either one of the above-mentioned apparatus for drying a coating material for marking, TAIKUREN (tradename: manufactured by WAKO KINZOKU KAGAKU Co., Ltd.), a coating material in which solvent is evaporated so that natural resin is

solidified when the coating material is heated up to 120 °C or more is used and the coating material for marking is dried by controlling the heating period of time t1 (180 sec.) and cooling period of time t2 (360 sec.) (refer to Fig. 8).

However, in the above-mentioned apparatus for drying a coating material for marking, problems in which coating material for marking can not be completely dried may happen since the predetermined temperature T2 which is necessary for drying can not be provided within the heating period of time t1. This is due to the fact that the air-tightness is not sufficient by the presence of a gap in the inlet and outlet for the continuous web 2, that there are variations in air temperature or the initial temperature in the drying chamber by the frequent use and that delay in temperature elevation of the coating material is caused by the water absorption properties of TAIKUREN. In the coating material of the type used in the conventional apparatus in which the natural resin is solidified by vaporizing the solvent, the natural resin may be dissolved when the coating material is left in atmosphere having a high temperature and humidity. When traverse winding and coil winding is conducted under conditions in which coating material for marking has not been dried enough and/or natural resin has been dissolved, undried coating material might be transferred to normal areas, which may be detected by the sensor. A transfer preventive double-sided laminate paper has previously been inserted on traverse winding or coil winding. This is inefficient in that an additional step for operation is necessary and has a problem in safety.

Since the distance between the inlet and the outlet for the continuous web 2 is long and the drying chamber has a large volume in conventional drying apparatus, the areas other than coating material applied areas may be heated so that their colors and/or physical properties of the metal may change.

The present invention was made to overcome the above-mentioned problem of the prior art.

It is therefore an object of the present invention to provide an apparatus for curing a coating material for marking on a continuous web, which can completely heat-cure the coating material to prevent it from being transferred to normal areas.

It is another object of the present invention to provide an apparatus for curing a coating material for marking on a continuous web in which heating of the areas other than coating material applied areas are minimized.

SUMMARY OF THE INVENTION

The present invention provides an apparatus for curing a coating material for marking applied on welded or defected areas of a continuous web having a lower case and upper case which is operably mounted on said lower case, said lower and upper cases surrounding the continuous web which extends in a longitudinal direction, characterized in that the length of the continuous web covered with the lower and upper cases in an advance direction of the web is preset to 150 mm or less and in that the inlet and outlet for the continuous web on the lower and upper cases are sealed by bringing sealing members having a flexibility provided at the inlet and outlet into contact with the lower and upper faces of the continuous web.

The invention as defined in Claim 2 is characterized in that two pairs of front and rear support columns erect on a working platform, shafts, each being bridged between a pair of support columns so that two shafts are in parallel with each other, a pair of bushes are slidably mounted around each of the shafts, said upper case being operably mounted on the lower case by means of a first link which links said upper case to one of said linear bushes and a second link which links the middle portion of the first link to the other of said linear bushes, said lower case being supported by the pair of linear bushes via support members having an extendible mechanism responsive to the changes in the distance between the pairs of linear bushes, said lower and upper cases being respectively provided with a hot air blowing inlet for blowing hot air into a closed chamber through which the continuous web passes and with a discharge outlet for discharging the air from said closed chamber.

The invention as defined in Claim 3 is characterized in that a stand is reciprocally disposed on a working platform, a pair of horizontal support members for supporting said lower and upper cases, which are vertically slidably mounted on said stand, an actuator or actuators being disposed on said stand for vertically slidably supporting the pair of horizontal support members, said lower and upper cases being respectively provided with a hot air blowing inlet for blowing hot air into a closed chamber through which the continuous web passes and with a discharge outlet for discharging the air from said closed chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view showing one embodiment of an apparatus for curing a coating material for marking of the manual type of the present invention;

Figs. 2(a) to 2(c) are front, plan and left elevation views, respectively, of the marking coating material curing apparatus of Fig. 1;

Fig. 3 is a perspective view showing one embodiment of an apparatus for curing a coating material of the automatic operably type of the present invention;

Figs. 4(a) and 4(b) are a front sectional view and sectional view taken along the line A-A in Fig. 4(a) showing the marking coating material curing apparatus in Fig. 3, respectively;

Fig. 5 is a time chart for explaining the method of controlling the heating of the marking coating material curing apparatus of the present invention;

Figs. 6(a) and 6(b) are front and plan views, respectively showing a conventional manual type marking coating material drying apparatus;

Figs. 7(a) and 7(b) are front and right elevation views showing a conventional automatic operable type marking coating material drying apparatus; and

Fig. 8 is a time chart for explaining the method of controlling the heating of the conventional marking coating material drying apparatus.

DESCRIPTION OF THE EMBODIMENTS

Now, an apparatus for curing a coating material for marking on a continuous web of the present invention will be described with reference to the drawings.

Fig. 1 is an exploded perspective view of an embodiment of a manual type of apparatus for a curing coating material for marking on a continuous web of the present invention; Figs. 2(a) to (c) are front, plan and left elevation views of the apparatus of Fig. 1, respectively.

An apparatus 10 for curing a coating material for marking of the present invention comprises a lower case 12, and upper case 14 that is operably mounted on the lower case 12, a blower 16 for blowing air into the lower and upper cases 12 and 14, and an opening/slide mechanism 20 for opening the upper case 14 with respect to the lower case 12 and for reciprocating both cases with respect to a working platform 1.

The lower case 12 has a closed chamber 12a that is opened upwardly and is provided on one side wall thereof with an air inlet 12b through which heated or cooled air is blown and an air outlet 12e through which air is discharged from the closed chamber 12a. A ceramic heater 12g, the temperature control of which is easy and which is capable of heating air in a short period of time, is directly disposed in the air inlet 12b. On the other

hand, it is preferable that an operable valve be provided in the air outlet 12e so that the temperature in the closed chamber 12a is not influenced by the amount of air discharged from the air outlet 12e.

Sealing members 12c, 12d having a flexibility are provided on the upper face of the lower case 12 where the continuous web 2 enters and exits. Sealing members 12c, 12d are adapted to prevent air from entering at entering position or exiting at exit position by the contact of the lower face of the continuous web with the sealing members and sealing members with themselves. Sealing members 12c, 12d may be made of various materials such as unwoven fabric such as felt and rubber. A handle 12 is mounted on one side of the lower case 12.

The upper case 14 is in a mirror-image relationship with respect to the lower case 12 and has a closed chamber 14a which is opened downwardly. The lower case 14 is provided on one side wall thereof with an air inlet 14b and outlet 14e. Sealing members 14c, 14d having a flexibility are provided on the lower face of the upper case 14 where the continuous web 2 enters and exits. A handle 14f is secured to one of the outer side of the upper case 14.

The opening/slide mechanism 20 comprises front and rear pairs of columns 21 that stand on the working platform 1. A shaft is bridged between a pair of front and rear columns 21. A pair of shafts 22 are disposed in parallel with each other. A pair of linear bushes 23 are slidably mounted around each shaft 22. The pair of linear bushes 23 can be moved toward or away from each other or can slide in the one and same direction.

The linear bushes 23 that are in the right side as viewed in the drawing are linked to the upper case 14 through first links 24. The middle portions of the first links 24 are linked to the left side linear bushes 23 through second links 25. Therefore, when the front linear bushes 23 move toward the rear linear bushes 23, the upper case 24 is opened with respect to the lower case 12. When the bushes 23 move away from each other conversely, the upper case 24 is closed with respect to the lower case 12.

The linear bushes 23 that are in the right side as viewed in the drawing are secured to the lower cases 12 via a lower linkage member 26. The middle portions of the linkage members 26 are formed with cam grooves 26a. Cam followers 27 that are rotatably journaled by the linear bushes 23 which are in the left side as viewed in the drawing. This enables the cam followers 27, that is, the left side linear bushes 23 can move with respect to the linkage member 26, that is, the right side linear bushes 23 by a distance L in a longitudinal direction of the cam groove 26a.

When the upper case 14 is depressed in a right direction as viewed in the drawing while the upper case 14 is opened, the cam followers 27 are moved to the right end of the cam grooves 26a to prevent further movement thereof. The lower and upper cases 12 and 14 are moved together to a position represented by a two dot and chain line (see Fig. 2(a)) so that the whole of the curing apparatus is offset from a line along which the continuous web extends.

As is best shown in Fig. 2(c), the length of the continuous web 2 that is covered with the lower and upper cases 12 and 14 is preset to a very short length, i.e., 150 mm or less, and is sealed in the entrance and exit positions with sealing members 12c, 12d and 14c, 14d. Accordingly, the seal chambers 12a, 14a can be hermetically sealed so that coating material for marking can be completely heated to cure to prevent the transfer of marking to normal areas and heating of the areas other than coating material applied areas can be minimized.

Although the conventional small manual type drying machine 50 is removed from a production line and conveyed to a separate position by an operator when the machine is not used, the curing apparatus 10 of the present invention can be installed in a position where the coating material for marking on the continuous web is to be cured or in a standby position adjacent thereto. Therefore, working efficiency is remarkably enhanced.

Fig. 3 is a perspective view showing one embodiment of an automatic operable type apparatus for curing a coating material for marking of the present invention. Figs. 4(a) and 4(b) are front sectional view and a sectional view taken along the line A-A in Fig. 4(a), respectively.

An apparatus 30 for curing a coating material for marking of the present invention comprises a lower case 32, an upper case 34 which is operable mounted on the lower case 32, a blower 36 for blowing air into the lower and upper cases 32 and 34; a stand 38 reciprocally disposed on the floor 1, a pair of upper and lower horizontal support members 40 which are vertically slidably mounted on the stand 38 through a slide mechanism 39 for supporting the lower and upper cases 32 and 34, respectively, and actuators 42 mounted on the stand 38 for driving a pair of horizontal supporting members 40.

In the illustrated and preferred embodiment, a pair of upper and lower actuators 42 that oppose to each other is mounted on the stand 38 to drive a pair of horizontal support members 40 in vertical directions as mentioned above. It is of course that an actuator may be provided for driving only one of the horizontal supporting members 40.

The lower case 32 has a closed chamber 32a which is open

upwardly and is provided on one side wall thereof with an air inlet 32b through which heated or cooled air is blown and an air outlet 32e through which air is discharged from the closed chamber 32a. A ceramic heater 32g, the temperature control of which is easy and which is capable of heating air in a short period of time, is directly disposed in the air inlet 32b. On the other hand, it is preferable that an operable valve be provided in the air outlet 32e so that the temperature in the closed chamber 32a is not influenced by the amount of air discharged from the air outlet 32e. Sealing members 32c, 32d having a flexibility are provided on the upper face of the lower case 32 where the continuous web 2 enters and exits. Sealing members 32c, 32d are adapted to prevent air from entering at entrance position and exiting at exit position by the contact of lower face of the continuous web with the sealing members and sealing members with themselves. A deflector plate 32f that deflects heated air from the blower 36 to uniformly blow it upon the lower face of the continuous web 2 is preferably mounted on the inner side of the lower case 32.

The upper case 34 is in a mirror image relationship with respect to the lower case 32 and has a closed chamber 34a that is opened downwardly. The upper case 34 is provided on one side wall thereof with an air inlet 34b and outlet 34e. Sealing members 34c, 34d having a flexibility are provided on the lower face of the upper case 34 where the continuous web 2 enters and exits. A deflector plate 34f is also mounted on the inner side of the upper case 34 for uniformly blowing heated air upon the upper face of the continuous web 2.

The slide mechanism 39 comprises a pair of guide shafts 39a that are secured to a vertical face of the stand 38 and linear bushes 39 through which the guide shaft 49 slidably extend. A pair of horizontal support members 40 are supported on respective linear bushes 39b in a cantilever manner.

As is best shown in Fig. 4(b), the length of the continuous web 2 that is covered with the lower and upper cases 32 and 34 is preset to a very short length, i.e., 150 mm or less, and is sealed in the entrance and exit positions with sealing members 32c, 32d and 34c, 34d. Accordingly, the closed chambers 32a, 34a can be hermetically sealed so that a coating material for marking can be completely heated to cure to prevent the transfer of marking to normal areas and heating of the area other than coating material applied area can be minimized.

When the curing apparatus is not used, it is moved in a right direction as viewed in the drawing by an operator so that the whole of the curing apparatus 30 is removed from the production line along which the continuous web 2 extends.

A way of using the marking coating material curing apparatus of the present invention will be described by an example of the automatic operable type marking coating material curing apparatus 30 shown in Figs. 3 and 4 with reference to Fig. 5. An operator withdraws the curing apparatus 30 from a standby position to a curing position. At this time, the lower and upper cases 32 and 34 of the curing apparatus 30 are opened. Withdrawal of the curing apparatus to the curing position causes the continuous web 2 having marking coating material applied thereon to be inserted between the lower and upper cases 32 and 34.

The actuators 42 are operated to slide the lower and upper cases 32 and 34 by the slide mechanism 39 in a vertical direction so that the continuous web 2 is interposed between the upper and lower cases 32 and 34. At this time, the continuous web 2 is brought into contact with the sealing members 32c, 32d and 34c, 34d and is sealed at the entrance position and exits position of the curing apparatus 30. When the blower 36 and the heaters 32g, 34g are energized, heated air is blown into the closed chambers 32a, 34a via the air inlets 32b, 34b and is impinged upon the deflector plates 32f, 34f so that it is deflected. After deflection, the air is uniformly blown upon the upper and lower faces of the continuous web 2. This causes the coating material for marking on the web 2 to be heated to cure. After the blowing upon the upper and lower faces of the continuous web 2, the heated air changes its direction and is discharged from the outlets 32e, 34e. The air pressure P1 in the air inlets 32b, 34b are preset to 10 milli-bar to 110 milli-bar. The flow rate V1 is preset to 900 to 16000 liters/minute.

In the marking coating material curing apparatus of the present invention, a heat curable resin such as MARK NT (tradename; METAL MARK 712 or 792 manufactured by The Inkteck Co., Ltd.) which chemically reacts and is heat-curable at 180 °C or more is used as a coating material for marking. In order to control the heat curing, the period of time t3 since the temperature in the closed chambers 32a, 34a becomes a predetermined temperature T1, specifically 180 °C or more, and the period of time t4 until the temperature becomes the original temperature T0 in the closed chambers are controlled. Since MARK NT is a polyester resin, and melamine resin, but is not shellac resin such as TAIKUEREN, its curing involves chemical changes and does not have water absorption properties. Therefore, even if t3 is 180 seconds or less, there are no variations in curing conditions of the coating material for marking and the coating material can be completely cured.

In the marking coating material curing apparatus of the present invention, the length of the continuous web 2 that is covered with the lower and upper cases 32 and 34, that is, which is exposed to heated air is preset to 150 mm or less so that heating of the areas other than the areas on which coating material is applied is minimized.

In the apparatus for heat-curing a coating material for marking on the web of the present invention in which the continuous web that extends in a longitudinal direction is surrounded by the lower case and the upper case that is operable with respect to the lower case, the length of the continuous web that is covered with lower and upper cases is preset to 150 mm or less and is sealed by the contact with the sealing members having a flexibility at inlet and outlet of the lower and upper cases. Accordingly, the coating material for marking is prevented from being transferred to normal areas by completely curing the coating material. Heating of the areas other than coating material applied areas can be minimized. Since there is no risk of transfer for marking coating material to normal areas, necessity of insertion of transfer preventive double sided laminate paper on traverse winding or coil winding is eliminated. Safety of operation is improved. Irregular changes in color or changes in physical properties of metal in areas other than coating material applied areas can be prevented.



THIS SHEET HAS BEEN
REPLACED

What is claimed is:

1. An apparatus for curing a coating material for marking applied on welded or defected areas of a continuous web having a lower case and upper case which is operable mounted on said lower case, said lower and upper cases surrounding the continuous web which extends in a longitudinal direction, characterized in that the length of the continuous web covered with the lower and upper cases in an advance direction of the web is preset to 150 mm or less and in that the inlet and outlet for the continuous web on the lower and upper cases are sealed by bringing sealing members having a flexibility provided at the inlet and outlet into contact with the lower and upper faces of the continuous web.

2. An apparatus for curing a coating material for marking on a continuous web as defined in Claim 1 characterized in that two pairs of front and rear support columns erect on a working platform, shafts, each being bridged between a pair of support columns so that two shafts are in parallel with each other, a pair of bushes are slidably mounted around each of the shafts, said upper case being operable mounted on the lower case by means of a first link which links said upper case to one of said linear bushes and a second link which links the middle portion of the first link to the other of said linear bushes, said lower case being supported by the pair of linear bushes via support members having an extendible mechanism responsive to the changes in the distance between the pairs of linear bushes, said lower and upper cases being respectively provided with a hot air blowing inlet for blowing hot air into a closed chamber through which the continuous web passes and with a discharge outlet for discharging the air from said closed chamber.

3. An apparatus for curing a coating material for marking on a continuous web as defined in Claim 1 characterized in that a stand is reciprocally disposed on a working platform, a pair of horizontal support members for supporting said lower and upper cases, which are vertically slidably mounted on said stand, an actuator or actuators being disposed on said stand for vertically slidably supporting the pair of horizontal support members, said lower and upper cases being respectively provided with a hot air blowing inlet for blowing hot air into a closed chamber through which the continuous web passes and with a discharge outlet for discharging the air from said closed chamber.

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