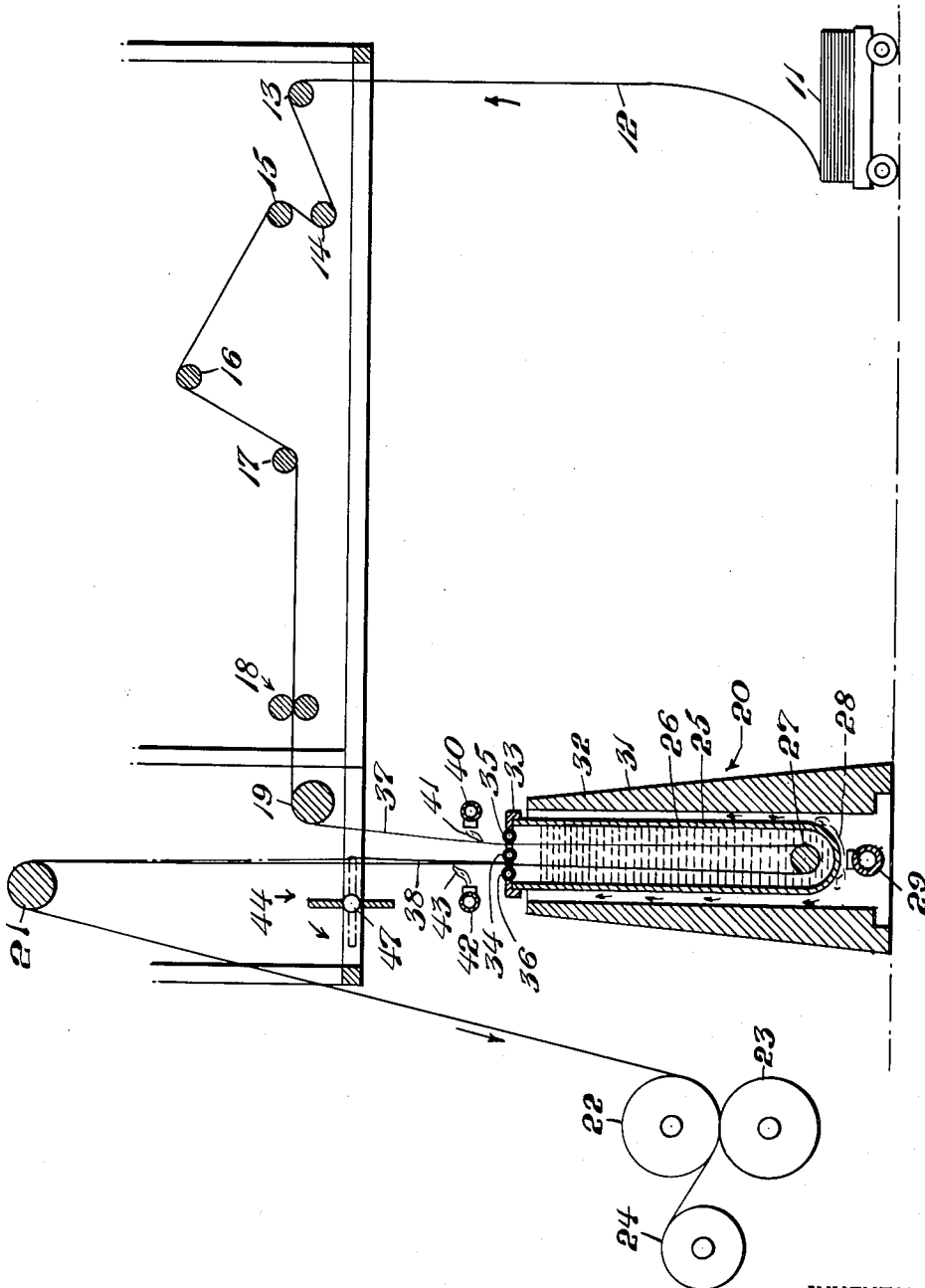


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METHOD AND APPARATUS FOR HEATING WEB MATERIAL
BY CONTACT WITH MOLTEN METAL
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METHOD AND APPARATUS FOR HEATING WEB MATERIAL BY CONTACT WITH MOLTEN METAL

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5 Claims. (Cl. 263—3)

This application is a continuation of our application Serial No. 97,298 filed June 4, 1949, now abandoned.

This invention relates to a machine for treating web material with molten metal to heat the same, and more particularly to the treating of textile fabric material as a step in the finishing process therefor.

Heretofore, it has been usual to cure resin treated fabric such, for instance, as a treatment of melamine-formaldehyde resin or urea-formaldehyde resin by subjecting the same to heat for a period of time such, for instance, as six to eight minutes to polymerize or cure the resin on the fabric. One of the methods of curing was to pass the fabric through a curing box at the rate of thirty yards per minute, which required that the box be sufficiently large to hold one hundred eighty to two hundred forty yards in order that in a continuous operation the material would be in the box for the desired length of time. Also, in using such a large box it was necessary that considerable heat be provided for this large box and the loss by radiation of heat became very large.

One of the objects of this invention is to speed up the operation of heat treating a web of material.

More specifically an object of the invention is to cure the resin on a fabric in the matter of three to twelve seconds rather than six to eight minutes.

Another object of the invention is to reduce the equipment necessary for heat treating a web of fabric.

Another object of the invention is to reduce the heat required for curing the fabric.

Another object of the invention is to reduce the space required for heat treating of a web of material.

Another object of the invention is to heat treat a web material by an arrangement using molten metal for applying heat to the fabric with an arrangement so that the molten metal which is used for applying heat to the material will not stick to the material.

Another object of the invention is to prevent oxidation of the molten metal which is used for treating a web of fabric.

With these and other objects in view, the invention consists of certain novel features, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawing:

The figure of the drawing is a diagrammatic view showing the travel of the material through the molten metal with the features of this invention incorporated.

In proceeding with this invention, we provide a bath of molten metal in a container which is heated by a gas flame, a chamber being provided for confining the heat to the bath container. A cover is located over the molten metal with slots in it for the admission and exit of the material to be treated which is to pass through the bath. Within this cover we provide for the discharge of an inert gas which will be supplied in a sufficient quantity so as to pass outwardly through the slots and prevent air or oxygen from entering and contacting the molten metal

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to oxidize the same. We also pre-heat the web material before it enters the bath so that it will not chill the metal contacted to an extent to cause the bath to solidify on the material. We also heat the material as it emerges from the bath and at the same time jar or shake or beat the material so as to dislodge any particles which might tend to stick to the material as it emerges from the bath, the heating assisting in keeping any sticking metal molten, that it might be more easily dislodged. In some cases a separate inert gas is discharged over the molten bath, while in other cases the resin treatment of the material is such that a gas will be liberated from the resin in sufficient quantities to make unnecessary a separate supply of inert gas.

With reference to the drawings, we have shown a framework 10 which supports a series of guide rolls over which the material to be treated, which is in web form, is led. A supply of web material may be drawn from a folded web 11 upwardly as at 12 over the guide roller 13 and through the tension device 14 and 15 and thence over guide rollers 16 and 17 through the aligner or guider 18, thence over guide roll 19 and into the molten metal bath which will be designated generally 20, and thence out of the bath over the guide roll 21 through the feeding rollers 22 and 23 and to a take-up roll 24.

The bath 20 comprises a container 25 which has in it a molten alloy metal 26. Different alloys will be hereinafter indicated. A roller 27 is located at a convenient point in the lower part of the container 25 so that the web material will pass downwardly beneath this roller 27 and then upwardly out of the bath. The molten metal is heated to the desired controlled temperature by a gas flame 28 supplied through the conduit 29. This gas flame will extend up both sides of the container to maintain the same hot and will be confined by a wall 31 containing some good heat insulation 32 so as to concentrate the heat that is supplied about the container 25.

A cover 33 is provided for the container 25 and has a pair of slots of a length substantially the same as the width of the web to be treated. These slots are narrow so as to just allow the web to pass. Under the cover and above the molten metal we have provided three tubes 34, 35, and 36 which are perforated with their discharge openings downwardly so that an inert gas may be supplied between the inwardly extending web portion 37 and the outwardly passing web portion 38 and also at either side of these webs to fill the space over the molten metal with this inert gas such, for instance, as carbon dioxide or nitrogen. The supply of this gas will be sufficient so that the gas will escape out through the slot and prevent the entrance of any air or oxygen over the molten metal to oxidize the same.

In order that the web of material will not enter the molten bath cold and thus cause any congealing of the metal immediately upon the surface of the web, we have supplied a heating means 40 shown as a gas burner for directing a flame 41 against the surface of the web prior to its entrance into the bath. Sufficient heat will be supplied so that the temperature of the web will be at least the temperature of the bath or above. The flame will be between 1800° F. and 2900° F. and will be located a sufficient distance from the web so that no singeing of the web will occur. We have found that two inches from the fabric is usually satisfactory. We also locate the flame from eight to eighteen inches above the level of the molten metal. The amount of heat absorbed by the web will be a function of the heat supplied and the speed of travel of the web and these two may be regulated to acquire the desired web temperature above the temperature at which the metal in the bath melts.

In the case of the treatment of some cloth, especially that which is fuzzy or rough, it may happen that some

metal will tend to cling to the material as it leaves the bath and, accordingly, we have provided a heating means 42 which in this instance is shown as a gas burner for directing a gas flame 43 against the material as it leaves the molten bath so that this molten metal will be kept soft and may be easily dislodged from the web 38. This burner will substantially duplicate the conditions of burner 40 above described. In order to dislodge or jar any adhering material from the web, we have provided some means to jar the material such, for instance, as a beater 44 which is located at a point well spaced from the molten bath and which has paddles 46 to strike the web 38 jarring it so that any material which might adhere to it is freed and will drop therefrom. It is found convenient to locate this beater at a point near midway between the bath and the guide roll 21, as shown by its shaft 47 rather than close to the bath, as this gives a more desirable vibration or jarring of the cloth. The speed of this beater and the length of the exit web of material from guide roll 21 to the bath will have a functional relation as to the point at which the best vibration may occur.

The molten bath which is provided is dependent somewhat upon the temperature at which it is desired that the material be treated. We will usually provide an alloy which will have a melting point at least thirty or forty degrees below the temperature at which it is desired that the treatment occur, although it will readily be apparent that the range may be higher. This will assist in preventing the metal from sticking to the fabric as it goes in or leaves the bath. Various melting points may be acquired, examples of which are as follows:

Pounds	Metal Alloy	Melts at—
50.....	Bismuth.....	160° F.
27.....	Lead.....	
13.....	Tin.....	
10.....	Cadmium.....	160° F.
50.....	Bismuth.....	
25.....	Lead.....	
12½.....	Tin.....	196° F.
12½.....	Cadmium.....	
52.....	Bismuth.....	
40.....	Lead.....	205° F.
8.....	Cadmium.....	
53.....	Bismuth.....	
32.....	Lead.....	210° F.
15.....	Tin.....	
6.....	Lead.....	
12.....	Tin.....	231° F.
7.....	Cadmium.....	
10.....	Bismuth.....	
30.....	Bismuth.....	232° F.
50.....	Tin.....	
30.....	Lead.....	
40.....	Bismuth.....	257° F.
40.....	Lead.....	
20.....	Tin.....	
50.....	Lead.....	257° F.
30.....	Tin.....	
20.....	Cadmium.....	

The length of time that the fabric will be immersed in the bath or be treated by the flame 41 and flame 43 will be dependent to a large extent upon the character of the fabric. Light-weight fabrics need be immersed in the bath only three seconds whereas heavier fabrics may be necessary to immerse up to twelve seconds. In the case of finishing cotton cloth where resin treatment is used, we have found that cloth treated with melamine-formaldehyde resin or urea-formaldehyde resin both require substantially the same length of treatment, the time being dependent upon the character of the fabric upon which the resin is used, rather than upon the character of the resin which is applied.

In some cases the mol for mol proportions of the formaldehyde to the urea or to the melamine is sufficiently high in the resin so that a gas of formaldehyde is given

off as the treatment occurs, this gas formaldehyde being present at the surface of the molten metal in sufficient quantities so that it will flow outwardly through the slots and make unnecessary the presence of tubes or conduits such as 34, 35, and 36. In the case of the proportions of the urea-formaldehyde resin, we have found that if one mol of urea is present with 1.8 or larger mol proportion of formaldehyde or if one mol of melamine is present with five mols or a greater proportion of formaldehyde, then the formaldehyde will be given off in sufficient quantity so as to make the separate supply of an inert gas unnecessary.

The curing of the melamine-formaldehyde resin or urea-formaldehyde resin will take place with the bath maintained at a temperature of from 350° F. to 400° F. The lower the temperature, the longer the time for curing will be required. Thus, there is another variable introduced which will be taken into account with the variation of the character of the cloth or material being treated.

We claim:

1. In an apparatus for finishing textile material, a bath of molten metal, means to guide a web of material to be treated into and out of said bath, a cover over the bath providing a substantial seal therefor, means for preheating the material outside of said seal in air to a temperature substantially that of the melting point of the metal used before entering said bath, and means outside of said seal for heating the material as it leaves said bath, and beating means outside of the seal to strip the bath from the web after leaving the bath.

2. In an apparatus for finishing textile material, a bath of molten metal, means to guide a web of material to be treated into and out of said bath, a cover over the bath providing a substantial seal therefor, means for preheating the material outside of said seal to a temperature substantially that of the melting point of the metal used before entering said bath, means outside of said seal for heating the material as it leaves said bath to a temperature substantially that of the melting point of the metal used, and beating means outside of the seal for stripping the web from any of the bath adhering thereto.

3. In an apparatus for finishing textile material, a bath of molten metal, means to guide a web of material to be treated into and out of said bath, flame means for preheating the material to a temperature substantially that of the melting point of the metal used before entering said bath, means for heating the material as it leaves said bath to a temperature substantially that of the melting point of the metal used, and means for jarring the material as it leaves said bath to dislodge all of the metal bath adhering thereto.

4. In an apparatus as in claim 3 wherein the jarring is by means of a beater against the material.

5. The method of applying heat to a textile fabric which comprises passing the same through a bath of molten metal which is at a temperature below that of injuring the textile fabric and simultaneously directing a flame against the fabric to preheat the same to substantially the temperature of the molten metal.

References Cited in the file of this patent

UNITED STATES PATENTS

1,430,651	Herman	Oct. 3, 1922
1,721,135	Ross	July 16, 1929
1,757,620	Decker	May 6, 1930
2,125,827	Turkington	Aug. 2, 1938
2,302,332	Leekley	Nov. 17, 1942
2,375,360	Herrick	May 8, 1945
2,450,847	Wilson	Oct. 5, 1948