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INK APPLYING ROLLER AND PROCESS OF PREPARATION THEREOF

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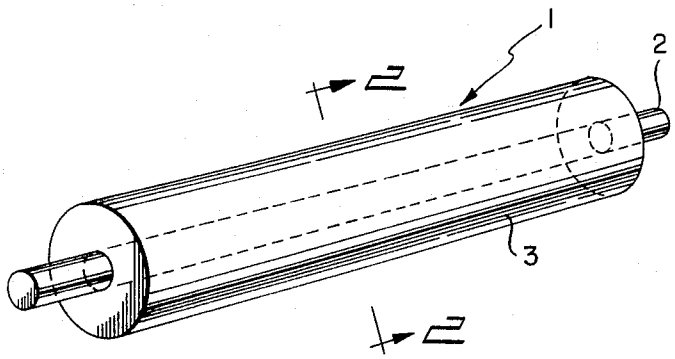


Fig. 1

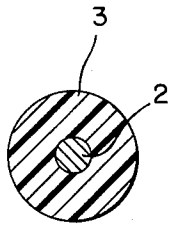


Fig. 2

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This invention relates generally as indicated to an ink applying roller, and more particularly to such a roller having a polyurethane surface and to a process for producing same.

One of the most commonly used types of inking rollers is that made from a composition of animal glue or such glue modified by glycerin or a like acting agent. Rollers of this type have received extremely widespread acceptance in the industry and are generally quite suitable for use in various printing processes, but do have certain disadvantages in that they are vulnerable to atmospheric conditions and to the action of ingredients contained in certain of the commercially used inks. For example, they are quite hygroscopic in nature and thus tend absorb moisture and swell when the humidity is high. Also, in warm weather, the glue compositions become very warm and flexible, whereas conversely, in cold weather, they become very hard.

Another type of inking roller which is commonly used is that having a surface formed of a polyester based polyurethane, such as that formed by reacting, for example, a branched adipate polyester with a diisocyanate. Such rollers also have many advantages and are particularly suitable for use with hydrocarbon based inks, but suffer from the disadvantage of being readily penetrable by vegetable oil inks, which are used in lithographic processes. By being susceptible to ink penetration, the roller surface will absorb the ink and a film of ink will thus be provided about the surface so that a residual color carryover problem is created, since any future printing will be done on a film of ink rather than on the roller surface.

Rollers of this type also have the further disadvantage, especially with the low durometer polyester based polyurethanes, that the polyurethane has a tendency to revert to the liquid state unless an inhibiting agent is incorporated therein, which is undesirable in that it increases the cost of and complicates the manufacture thereof.

It is an object of this invention therefore to provide an ink applying roller which is chemically and dimensionally stable and capable of retaining its concentricity during use.

Another object of this invention is the provision of an ink applying roller having a polyurethane surface which is not susceptible to penetration by lithographic inks.

An additional object of this invention is the provision of a process for making such a roller.

Other objects, features and advantages of this invention will become apparent to those skilled in the art after a reading and understanding of the following more detailed description.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

FIG. 1 is a perspective view of a roller of this invention; and

FIG. 2 is a transverse section on line 2—2 of FIG. 1.

Referring now more particularly to the drawing, it will be seen that these and other objects are achieved by means of this invention in which an ink applying roller 1 is provided comprising a substantially central metal shaft 2 and a surrounding solid homogeneous polyurethane ink applying surface 3 consisting essentially of the reaction product of castor oil and tolylene diisocyanate. The invention also includes a process for making such rollers as will be more completely described hereinafter.

As mentioned above, the ink applying surface is a polyurethane, and preferably a non-cellular polyurethane, which is formed by reaction of castor oil and tolylene diisocyanate. Numerous such diisocyanates are commercially available, with one preferred resin being that sold under the trade designation of Mondur TD–80 by the Mobay Chemical Company, this diisocyanate being an 80 percent to 20 percent mixed isomer of 2,4 and 2,6 tolylene diisocyanate. Other commercially available tolylene diisocyanates are also suitable for use in this invention, such as Hylene T manufactured by E. I. du Pont de Nemours & Company, and that sold under the trade designation Nacconate by the National Aniline Division of Allied Chemical and Dye Corp. The castor oil which is used may also be purchased commercially, with DB and No. 1 grade oils being the preferred oils and one source for such material being the Baker Castor Oil Company.

To be suitable for the desired use as a printing roller, and particularly for such use in the lithographic field, the roller should have a Shore A durometer hardness in the range of from about 10 to about 50, with the preferred range being from about 25 to about 30. To produce rollers having this hardness, the tolylene diisocyanate should be generally not greater than approximately 30 percent by weight of the tolylene diiocyanate-castor oil mixture. For example, if it is desired to produce a roller having a durometer hardness of about 40, approximately 25 weight percent of the diisocyanate will be used; 20 weight percent of the diisocyanate produces a roller having a durometer hardness in the range of 28 to 30 and about 18.5 weight percent of the diisocyanate will yield a hardness of about 15.

To prepare the roller of this invention, the castor oil and tolylene diisocyanate are thoroughly mixed in any suitable mixing vessel, it being preferred that agitation means be employed such as any of the propeller type agitators to assure such thorough mixing. The castor oil is generally placed into the mixing vessel at a temperature in the range of from about 120 to 140° F. while the tolylene diisocyanate is put in at room temperature (room temperature being understood to mean within the range of from about 65° F. to about 75° F.). Since castor oil is not hygroscopic in nature, it is not necessary to dehydrate the mix to avoid foaming during reaction. The mixing vessel is, after completion of the mixing, placed under a reduced pressure of, for example, 28 inches of mercury reduction below atmospheric pressure for approximately 10 minutes to remove any air or other gas which may have been mixed into the batch.

A roller shaft will be positioned within a roller mold, and the castor oil-diisocyanate solution is next cast or poured thereinto. Prior to this, the shaft should be cleaned so as to be free from grease, or alternatively, a suitable bonding agent, such as an acrylic resin dissolved in methylisobutyl ketone, applied thereto to insure that the ink applying surface will adhere firmly. If desired, a finely divided metallic filler may be included in the adhesive in order to impart a color for purposes of appearance. The mold should also be cleaned thoroughly, and it may be desirable to use a parting compound, such as a

silicon grease or a high viscosity oil, to insure that the roller may be readily removed after formation.

After properly centering the shaft or core within the mold, the castor oil-tolylene diisocyanate mixture is poured or cast thereinto, either from the top of the mold or being forced in from the bottom, depending upon the type of mold which is used. It has been found that it is not necessary to preheat the mold. The mold is thereafter placed in a suitable oven, and baked at a temperature in the range of about 140 to 300° F. for a period of from about 1 to 12 hours, with the time, of course, being dependent upon the particular temperature. The preferred heating range is from about 260 to about 300° F. for a period of about 1 to 2 hours. The heating within the oven, of course, causes the tolylene diisocyanate to react with the castor oil to form the desired polyurethane surface for the roller. After such reaction and curing or solidification, the roller is permitted to cool in the mold, as it has been found that the polyurethane surface is too brittle to be conveniently moved while still hot. Since the polyurethane expands slightly during the baking process and therefore contracts upon cooling, the roller may be readily removed from the mold after being cooled.

This invention will be better understood by reference to the following specific but non-limiting example.

Example

100 parts by weight of DB grade castor oil purchased from the Baker Castor Oil Company was placed into a Lightening propeller type mixing vessel at a temperature of approximately 130° F. 20 parts by weight of Mondur TD-80 tolylene diisocyanate purchased from the Mobay Chemical Company was added to the vessel, the diisocyanate being at approximately room temperature. The contents of the vessel were thoroughly mixed for approximately 7 minutes after which time the vessel was placed under a reduced pressure of 28 inches of mercury reduction to remove any air or other gas which was beaten into the mixture.

A metal shaft was next cleaned to insure that the surface was free from grease, and a roller mold was also cleaned and a silicon grease parting compound applied to the surface thereof. The shaft was next positioned within the mold and centered therein. The castor oil-diisocyanate mixture was next cast into the mold, and the mold was closed and placed into a baking oven. The temperature of the oven was raised to 260° F. and held at this temperature for a period of 2 hours to cause the castor oil and tolylene diisocyanate to react and to cure or solidify. The mold was removed from the oven and the roller was permitted to cool in the mold to approximately room temperature, after which it was readily removed therefrom. This roller was found to have a Shore A durometer hardness of approximately 28.

Rollers of this type have been extensively tested in various lithographic processes and have been found to have exceptional chemical and dimensional stability with a long useful working life. Such rollers have also been found to retain their concentricity and are not susceptible to penetration by lithographic inks and may be easily washed off after use with commercially available solvents for such purpose.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such be employed.

I therefore particularly point out and distinctly claim as my invention:

1. An ink applying roller comprising a substantially central shaft and a surrounding ink applying layer consisting essentially of the reaction product of castor oil and tolylene diisocyanate.

2. The roller of claim **1** in which up to approximately 30 percent by weight of tolylene diisocyanate was reacted with the castor oil.

3. An ink applying roller comprising a metal shaft and a surrounding solid, homogeneous ink applying polyurethane surface having a Shore A durometer hardness in the range of from about 10 to about 50 consisting essentially of the non-cellular reaction product of castor oil and up to approximately 30 weight percent tolylene diisocyanate.

4. The roller of claim **3** in which said tolylene diisocyanate is an 80 percent to 20 percent mixed isomer of 2,4 and 2,6 tolylene diisocyanate.

5. A process for preparing an ink applying roller comprising applying a layer consisting essentially of a mixture of castor oil and tolylene diisocyanate to a metal shaft, heating said shaft and layer to react the castor oil and diisocyanate and to cure and solidify said layer.

6. The process of claim **5** in which said shaft and layer are heated to a temperature from about 140 to about 300° F. for a period of from about 1 to about 12 hours.

7. The process of claim **6** in which said tolylene diisocyanate is up to approximately 30 percent by weight of said mixture.

8. A process of preparing an ink applying roller comprising placing a metal shaft in a roller mold, casting a mixture consisting essentially of castor oil and tolylene diisocyanate into the mold, and heating said mold and mixture to react said castor oil and diisocyanate and to cure and solidify such reaction product.

9. The process of claim **8** in which said tolylene diisocyanate is a maximum of about 30 percent by weight of said mixture.

10. The process of claim **8** in which the roller is cooled in the mold, and is subsequently removed therefrom.

11. The process of claim **8** in which said mold and mixture are heated to a temperature of from 140 to about 300° F. for a period of from approximately 1 to 12 hours.

12. The process of claim **11** in which said temperature is in the range of from about 260 to about 300° F. and said time is in the range of from about 1 to about 2 hours.

13. A process for preparing an ink applying roller comprising thoroughly mixing a mixture consisting essentially of castor oil and tolylene diisocyanate in a mixing vessel, placing said vessel under reduced pressure to remove gas bubbles from said mixture, casting said mixture into a roller mold and heating said mold and mixture to react said castor oil and tolylene diisocyanate and to cure and solidify such reaction product.

14. The process of claim **13** wherein said castor oil is at a temperature of about 120 to about 140° F. and said diisocyanate is at room temperature during mixing.

15. The process of claim **13** wherein said diisocyanate is a maximum of about 30 percent by weight based on said mixture.

16. An ink applying roller comprising a substantially central metal shaft and a surrounding homogeneous non-cellular ink applying surface consisting essentially of the reaction product of castor oil and tolylene diisocyanate.

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