PROCESS OF IMPROVING PLANOGRAPHIC PRINTING PLATES

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It has been found as disclosed in Patent No. 2,534,588 that rubbering or brushing improves the printing properties of planographic printing surfaces.

In the practice of this process on planographic printing surfaces formed of a finely divided mineral pigment and a hydrophilic adhesive in the form of a coating on a suitable base such as paper we have found that the results produced depend upon the material used for the brushing operation.

Although as stated in said patent the physical action of the rubbering or brushing treatment on the surface has not been fully explained, it is known that when brushing by means of a rotating brush is effective for improving the printing properties of the surface dust is produced which deposits on the surface and must be removed. It appears probable that the improved planographic printing properties of the surface are due to the removal thereof of the material of the dust and it appears further that the dust itself which adheres to the brush bristles and deposits on the surface during the action of the brush may act as an abrasive on the surface. Experience has led to the theory that certain kinds of brush bristles such as hog bristles which are effective have rough surfaces to which the dust adheres whereas other bristles which are less effective are smooth and do not retain the dust. This theory is based upon the observation that brushing with brush of hog or other natural bristles generates much more dust and is much more effective as to improving the planographic printing properties of a surface than is brushing with a nylon brush. It may be explained that the brushing generally is effected by passing the planographic surface in the form of a coated paper web over and in contact with a rotating brush having the bristles extending radially from a cylindrical core and that dust probably consisting principally of mineral pigment is dislodged from the coating adheres to the bristles and is rubbed against the surface by the movement of the bristles.

Brushing with a brush of nylon filaments when using the same pressure as is used effectively with a hog bristle brush generates relatively little dust and is relatively much less effective in improving the planographic printing properties. In the case of nylon which, as stated, produces very little dust when applied with the same pressure as is effective with hog bristles it is necessary to apply heavy pressure in order to produce substantial improvement of the printing properties of the plate and then the difficulty is encountered which we have called nylon toning i. e. when the brushed plates are used for printing, the background shows streaks, like brush marks, which pick up ink from the inking roller and transfer it to the prints made from the plates. Nylon toning may be avoided by brushing with a nylon brush but such brushing is not satisfactorily effective in improving the planographic printing properties of a coated paper printing plate so brushed.

The nylon monofilaments which have been and still are standard for use in the manufacture of brushes are made according to the disclosure of the Carothers Patent No. 2,130,523. According to that disclosure a diamine and a dicarboxylic acid are reacted together and the reaction product is then condensed to form a long polyamide.

In commercial practice the diamine most commonly used is hexamethylenediamine, NH₂(CH₂)₆NH₂ and the most commonly used dibasic acids are adipic acid, H(OOC(CH₂)₄COOH

and sebacic acid, HOOC(CH₂)₁₀COOH. Filaments of adipic acid nylon and sebacic acid nylon have been used extensively in brushes, with the sebacic acid nylon sometimes being preferred because of its greater rigidity and lower moisture absorption. For convenience nylon made from a diamine and a dibasic acid will be referred to as diamine-type nylon.

As Carothers explains nylon typically is made up of a long series of identical structural units. The length of the structural unit is indicated by the number of atoms in the chain. The shortest structural unit that can be made of a diamine-type nylon has a chain length of 9. The hexamethylenediamine-adipic acid nylon structural unit has a chain length of 14, and the hexamethylenediamine-sebacic acid nylon structural unit has a chain length of 18.

Diamine-type nylon filament brushes have been found to be effective for removing the dust created and deposited on the printing surface by the action of the more effective natural bristle brushes such as brushes of animal hair. In this use the diamine-type nylon filament brush may be applied lightly and when so applied may cause none or very little damage but even when used for this purpose damage is likely to occur if the pressure on the brush is not carefully controlled. The dust created by brushing with a hog bristle brush adheres strongly to the plate and there is therefore a tendency to apply more pressure to the nylon filament brush for removing the dust and this tendency frequently leads to the damage called nylon-tone.

The cause of nylon-tone is not certain but it is assumed that it is due to the material of the nylon bristles rubbing off onto the plate and thus providing a surface which picks up ink in the printing process. It is believed that the nylon-tone may not develop immediately after the brushing operation when it might be detected and the brushing operation corrected with only relatively little damage. In some cases the damage develops only after a nylon brushed plate has been aged for several months. It is assumed that the material of the nylon bristles rubs off onto the surface of the plate and then, upon aging, is modified in some way e. g. by oxidation, so that it becomes ink receptive.

Having discovered that diamine-type nylon filament brushes are not satisfactory as the sole brushing means for improving the printing properties of planographic printing plates and that their use in conjunction with the use of brushes of other materials such as hog bristles merely for removing the dust created by such other brushes is hazardous, we undertook to obviate the difficulties involved in the use of diamine-type nylon brushes because they have desirable characteristics with respect to cost, wearing qualities and ability to remove dust. We have discovered that brushes, the bristles of which are made of a grade or kind of nylon which was not expected to give a satisfactory brush, or which alternatively the nylon-tone and gives satisfactory results in other respects when used in conjunction with, brushes of other materials such as hog bristles for removing the dust deposited on the plates by the action of such brushes.

Brushes which we have found very satisfactory to remove dust from coated planographic printing plates without at the same time causing the plates to develop nylon-tone are brushes having monofilament bristles made of
the type of nylon described in the Carothers Patent No. 2,071,253. According to Patent No. 2,071,253 long polyamides are made by condensing an amido acid, or amido-forming derivative thereof, which has at least 5 carbon atoms in the chain separating the reactive end groups. Of these 6-amino caproic acid, NH₂(CH₂)₅-COOH, is typical. It is to be noted that in this case the chain length of the structural units which make up the nylon formed therefrom is only 7, in contradistinction to 9 which is the lowest possible number in the case of any diamine-type nylon and to 14 and 18 which are the numbers in the structural units of the usual hexamethylene diamine-adipic acid and hexamethylene diamine-sebacic acid nylons commonly used in brushes. Nylon made from a single starting material, that is an amino acid or amido forming derivative thereof, may be called "amino acid-type nylon" to distinguish it from the diamine-type nylon made from a mixture of diamine and dibasic acid.

Brushes made of filaments of nylon based on the structural unit

\[-NH-CH₂-CH₂-CH₂-CH₂-CH₂-O-\]

are very satisfactory for our use. Such brushes efficiently remove dust from coated planographic printing plates previously brushed with a brush of animal hair or other brush which leaves dust on said plates. With the exercise of ordinary care on the part of the operator such brushes give no trouble whatever by causing development of nylon-tone. It is possible to cause nylon-tone with brushes of such nylon by use of excessive pressure. But the pressure required to cause nylon-tone is at least twice the pressure necessary for efficient dust removal; so nylon-tone from use of such brushes will result only from gross and inexcusable error in adjusting the brushing pressure. This is in direct contradistinction to the case when regular diamine-type nylon brushes are used. With diamine-type nylon brushes the margin between the pressure required for efficient dust removal and the pressure that causes nylon-tone is so extremely narrow that it has been found impossible in continuous commercial brushing of coated planographic printing plates to maintain at all times the delicate balance between pressure sufficient to remove dust and pressure above which nylon-tone resulted. Consequently a considerable proportion of plates brushed with the diamine-type nylon brushes have been spoiled, and since, as has been previously mentioned, in many cases the spoilage did not become apparent until after several months and after the plates had been sold, the use of diamine-type nylon brushes became too risky to be continued. On the other hand the present invention substantially eliminates risk of causing nylon-tone during the brushing operation.

Nylon of identical composition can be made from 6-amino caproic acid and from its anhydride, caprolactam. Since the anhydride is more easily produced than the acid itself it is the starting material commercially used for this type of nylon.

Monofilaments made from amino acid-type nylons exemplified by nylons made from 6-amino-caproic acid, nylons made from caprolactam, and nylons having as their essential structural units one which may be indicated as

\[-NH-CH₂-CH₂-CO-\]

are characterized by their limp texture, being only about half as stiff as conventional brush filaments made of diamine-type nylon. Such nylon filaments have not in the past been considered adapted for use as brush bristles. It was considered that such filaments would have insufficient stiffness and would tend to mat together if used in a brush. We have found, however, that a brush made of monofilaments of nylon based on a structural unit of 7 atoms is effective for the removal of dust from brushed planographic printing plates and that such a brush can be used freely without the production of the so-called nylon-tone. Brushes made of such monofilaments have the further advantage that they wear away less rapidly and last longer than brushes made of nylon filaments derived from diamine-type nylon such as adic acid-diamine and sebacic acid-diamine copolymers.

Our invention therefore resides in the process of improving the printing properties of planographic printing plates by brushing them successively with a brush which generates dust and leaves dust on the plate and then with a brush having bristles of nylon based on the structural unit

\[-NH-CH₂-CH₂-CH₂-CH₂-CH₂-O-\]

to remove the dust. The brush which generates the dust may have bristles of animal or vegetable fiber or even of very fine metal wire, through the latter is so harsh that it must be used with extremely great care. Animal fibers usable include hog hair, horse hair, badger hair, mohair, sheep's wool, etc.; vegetable fibers include those of cotton, tampico, bassine, jute, hemp, flax, etc.

We claim:

1. Process for improving the printing properties of planographic printing plates which comprises brushing the surface of the plate with a natural bristle brush and thereafter brushing said surface with a brush formed of nylon filaments based upon the structural unit

\[-NH-CH₂-CH₂-CH₂-CH₂-CH₂-O-\]

2. Process for improving the printing properties of a planographic printing plate having at least a surface layer consisting principally of a pigment and a hydrophilic adhesive which comprises brushing said surface layer with a natural bristle brush with sufficient pressure to generate dust and then brushing said surface with a brush having bristles consisting of nylon filaments based upon the structural unit

\[-NH-CH₂-CH₂-CH₂-CH₂-CH₂-O-\]

3. Process as defined in claim 1 in which the nylon of the filaments is based upon caprolactam.

4. Process as defined in claim 1 in which the bristles of the natural bristle brush are hog bristles.

5. Process as defined in claim 1 in which the bristles of the natural bristle brush are hog bristles and the nylon of the filaments is based upon caprolactam.

6. Process as defined in claim 2 in which the nylon of the filaments is based upon caprolactam.

7. Process as defined in claim 2 in which the bristles of the natural bristle brush are hog bristles.

8. Process as defined in claim 2 in which the bristles of the natural bristle brush are hog bristles and the nylon of the filaments is based upon caprolactam.

No references cited.