Jan. 18, 1966 S. G. PETERSON ET AL 3,229,351

DAMPENING ROLL COVER AND ITS USE IN LITHOGRAPHIC PRINTING

Filed July 16, 1962

FIG. 1

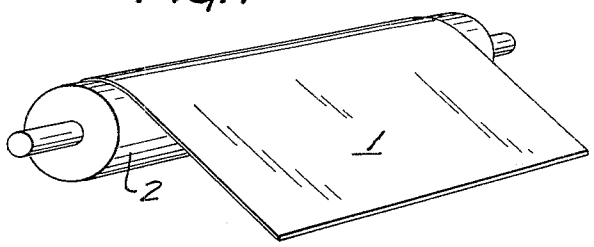


FIG. 2

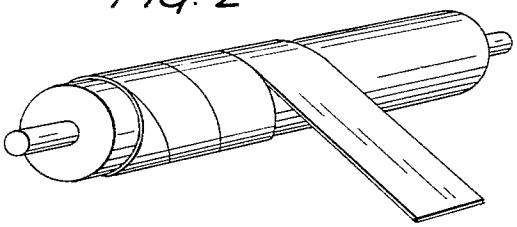


FIG. 3

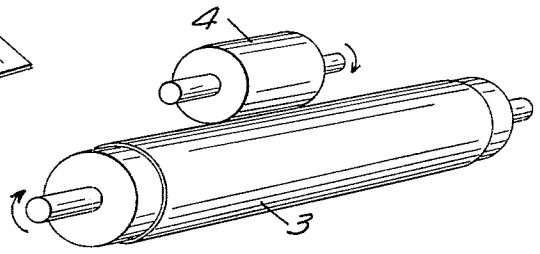


FIG. 4

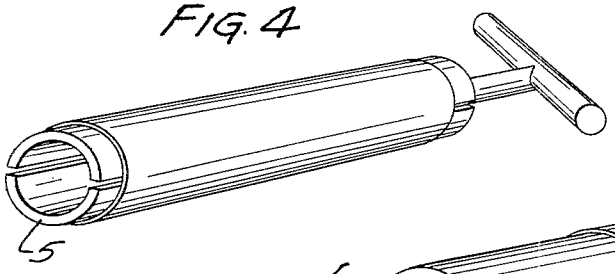


FIG. 5

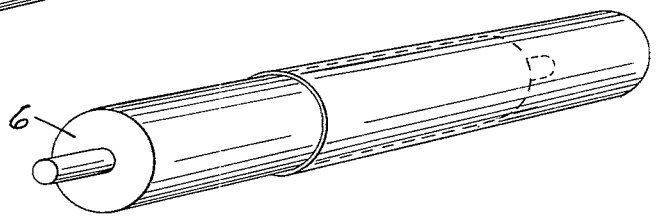
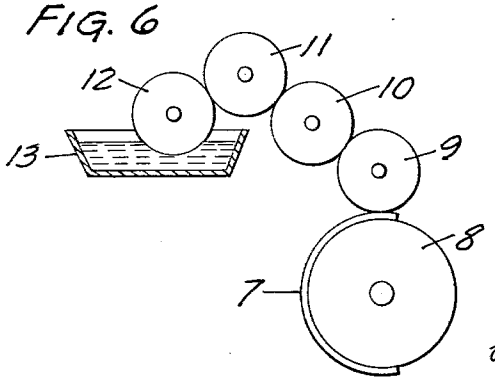


FIG. 6



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DAMPENING ROLL COVER AND ITS USE IN LITHOGRAPHIC PRINTING

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This invention relates to a new and useful dampening roll cover for use in lithographic printing. In one aspect, this invention relates to a non-woven dampening roll cover which is economical to manufacture and also both convenient and efficient to use in lithographic printing processes.

In lithographic printing, it is necessary to selectively wet the surface of a printing plate with water before the application of oil-based printing inks. To selectively wet a lithographic printing plate, a cloth covered dampening roll or rolls has heretofore conventionally been used. These cloth covered rolls are moistened with water and thereafter passed over the surface of the printing plate, the wetting action being achieved by the deposit of water pressed out of the porous cloth upon the plate surface. With such cloth covered rolls, however, it has been a problem to uniformly wet the printing surface without also depositing foreign substances, such as lint, from the cloth cover. Moreover, the cloth cannot be readily cleaned, and the operator of the lithographic press must consequently compensate for the variable wetting action frequently obtained with use of such cloth covers. Such covers have been applied with difficulty to the roller by securing the cover at each end with stitching. The worn covers are later removed by cutting away the stitching at each end. In actual use, cloth covered rolls tend to compact, thus changing in porosity as well as in diameter during the printing run. Because the proper water-ink balance must be maintained for optimum results, frequent adjustments on the printing press have often been necessary to compensate for these changes.

Convolutely wrapping multiple layers of non-woven fabrics about the dampening roll has also been suggested, but such covers have an outer trailing edge that can disrupt the desired uniformity of the dampening roll surface. Moreover, covers of this type are difficult to attach snugly over the roll.

It is therefore an object of this invention to provide a non-woven dampening roll cover of improved design for use in lithographic printing and a process for its manufacture.

Another object of this invention is to provide a seamless dampening roll cover which is convenient and economical to use and which fits snugly on the roll.

Still another object of this invention is to provide a dampening roll cover which is more capable of applying in controllable fashion a uniform quantity of water under a lithographic plate with a minimum of adjustment during the printing run.

Other objects of this invention will be apparent from the following description.

In accordance with this invention, the new and useful dampening roll cover comprises a seamless, cohesive, porous, hygroscopic, non-woven cylindrical sleeve having a uniform surface texture, said sleeve being comprised of hydrophilic, randomly disposed, fibers which (1) are substantially water insoluble at temperatures below about 100° F., preferably below 170° F., (2) can be longitudinally expanded, preferably at least 3%, when water wetted, (3) have dimensional stability when dry, and

(4) longitudinally contract from their expanded state when water wetted, the sleeve also being resistant to tearing, abrasion and fiber disorientation when water wetted.

Non-woven webs and fabrics of a wide variety of materials are well known, and the preparation or selection of appropriate non-woven webs or fabrics containing fibers with the aforementioned properties can readily be determined by those skilled in the art. The following simple test procedure can be used to determine the suitability of any fibrous material or materials in non-woven form.

After the hydrophilic properties of the non-woven sample are positively established (i.e. oleophobic when water wetted), a 2-inch by 3-inch specimen is cut from the sample. Marks are made ½-inch from each end, 2 inches apart. The specimen is then wetted thoroughly with water, and each end is clamped in one jaw of a suitable tester, such as a tensile test device. The jaws are separated at a rate of one-inch per minute until an elongation of at least 2 percent is achieved. The specimen is then permitted to dry in this expanded condition. The dry specimen is then removed from the tester and placed in an oven at 70° F. and 10% relative humidity for at least 24 hours. No significant contraction should occur during this exposure. The specimen is then again thoroughly wetted with water, and the contraction is measured. The rewetted specimen should recover at least about 30 percent of its total expansion.

If a single specimen, swatch or layer of non-woven material does not meet the above test requirements, several layers of the same or different non-woven material may be bonded together to improve its performance. By using a hydrophilic fiber and/or a resin which is heat fusible or heat and moisture fusible in conjunction with the other hydrophilic fibers in the non-woven web, several layers of the web may be bonded together by the application of either heat alone or heat and moisture while subjecting the several layers to pressure in a suitable device, such as a heated hydraulic platen press. The particular conditions of heat, moisture and pressure depend, of course, on the fibers or resins employed. Preferably, the pressure should be sufficient to compress the several layers to about 20 percent of their original combined thickness.

A particularly preferred class of hydrophilic fibrous material for the non-woven web is the polyvinyl alcohol fibers, especially those polyvinyl alcohol fibers with a denier from about 0.5 to about 6 and an individual average fiber length of from about 0.25 to about 2 inches (preferably 0.5 to 1.5). Polyvinyl alcohol fibers are available in various grades, depending on their solubility characteristics in hot water. Other useful heat fusible fibers, i.e. fibers capable of being cohered or bonded to each other upon application of heat and pressure with or without the presence of moisture, include the polypyrrolidone fibers. In general, the inclusion of additional hydrophilic fibers, not necessarily heat fusible, in the non-woven web is preferred. Fibers such as cotton, regenerated cellulose, viscose rayon, cellulose acetate rayon and other rayons, may thus also be incorporated to modify the properties of the non-woven web and hence of the sleeve, e.g. increase strength and hydrogroscopic properties, etc. Saponified cellulose acetate fibers, particularly those in which cellulose acetate fibers are saponified in their oriented condition during their manufacture (e.g. Fortisan fibers) and having a denier from about 0.5 to about 3 and an average fiber length of from about 0.25 to about 2 inches (preferably 0.5 to 1.5), in combination with at least 20 weight percent of polyvinyl alcohol fibers provide a non-woven material having outstanding properties when used as a dampening roll cover in accordance with this invention. Fortisan fibers are described in "Man-Made Fibers," R.

W. Moncrieff (J. Wiley and Sons, 1957), pp. 221–223. Occasionally, it is found that a small amount of a binder, e.g. a water soluble polyvinyl alcohol resin, may be applied, preferably from solution, to the dry fibers in the preparation of the non-woven material to assist in bonding the fibers together into a cohesive web. Usually a maximum of about 5 weight percent, preferably less than about 2 weight percent, of the non-woven web is binder, particularly when the more water soluble binders are employed.

The preparation of non-woven webs from dry fibers, either with or without additional binder materials, may be carried out by conventional means, e.g. a Rando-Webber machine, etc. The average fiber lengths of 0.5 to 2 inches are useful in the dry process for preparing non-woven webs. Non-woven webs of 15 mils maximum thickness, preferably of 10 mils maximum thickness, are generally most useful.

The process of manufacturing the non-woven sleeve of this invention can better be understood by reference to the drawings.

FIGURE 1 shows the step of wrapping one or more turns of a strip of non-woven web material **1** around a mandrel **2**. In FIGURE 2 a wetted curing tape, i.e. a tape which shrinks upon drying, such as the nylon cure tape commonly used in the manufacture of rubber rolls, is wrapped tightly about the mandrel over the multiple layers of non-woven web. This is then heated in the presence of moisture, e.g. a moist atmosphere, to a temperature sufficient to effect at least a partial fusion of some of the non-woven fibers to each other, e.g. 200° F. to 300° F. for polyvinyl alcohol fibers and to produce a cohesive sleeve. As the fusion occurs, the layers of non-woven web are simultaneously placed under radial compression due to the contraction of the cure tape. Other means for obtaining the desired radial compression can be used in place of cure tape, as will be readily appreciated. In general, a radial compression to a maximum of 50 percent of the original thickness of the non-woven layers is preferred to obtain a high density product, although the amount of compression may vary widely depending on the original density of the non-woven web. After drying, the cure tape is removed and, if desired, the exposed exterior surface **3** is sanded to remove surface irregularities. Such sanding may be accomplished by rotating the sleeve and mandrel at high speed while contacting the surface with a rotating sanding wheel **4**, as shown in FIGURE 3.

The sleeve is then slipped over an expandable mandrel **5**, as shown in FIGURE 4, wetted with water and mechanically expanded at least about 2 percent in diameter, preferably about 5 percent. The expanded sleeve is dried in its expanded condition, in which state the sleeve retains its expanded dimensions and is ready for use as dampening roll cover. The expandable mandrel is then removed. The dry sleeve may readily be slipped over a dampening roller **6** as shown in FIGURE 5. Upon moistening with water, the sleeve contracts to the dimensions of the roller and tightly adheres to its surface. It is therefore an essential property of the mat material used in making the sleeve of this invention that it is capable of being expanded in its wetted condition, that it retain its expanded dimensions after drying, and that it shrinks significantly upon rewetting. The operation of the sleeve covered dampening roller is shown in FIGURE 6. A curved printing plate **7** on rotating printing roll **8** is wetted by the covered dampening roller **9** which is also in contact with vibrator roll **10**. The vibrator roll is in turn contacted by ductor roll **11** and fountain roll **12**, which transfers moisture from the fountain reservoir **13**. This technique is conventional in the lithographic art.

To illustrate this procedure, a dry 11-inch by 32½-inch sheet of non-woven web material containing 50 weight percent of Fortisan 36 fiber (resaponified cellulose acetate rayon product, tensile strength of 155,000 p.s.i., specific gravity of 1.52, a product of Celanese Corporation of America) and 50 weight percent of substantially water insoluble polyvinyl alcohol fiber (unacetylyzed and non-heat treated) along with a small amount of water soluble polyvinyl resin (Elvanol 72–60, product of E. I. du Pont de Nemours and Co.), was wrapped convolutely around a 2.000 inch diameter mandrel. Exactly five wraps or convolutions were made so that the trailing edge was directly over the leading edge, though separated by four layers of the web. This wrapped mandrel was then spirally overwrapped with a wet nylon cure tape, and the overwrapped mandrel was placed in an open steam autoclave at 40 pounds per square inch gauge pressure for 15 minutes at 285° F. After removal from the autoclave, the cure tape was allowed to dry before it was removed, leaving the five layers of web cohered into a dense, uniform, unitary sleeve. This sleeve was then sanded with 150 grit sandpaper to remove the cure tape pattern on the sleeve surface. The sleeve was removed from the mandrel and was slipped over a mechanical expander consisting of a 2-inch outside diameter pipe, split along its axis into two sections. After moistening the sleeve with water, wedges were driven between the pipe sections at each pipe end to increase the circumference of the sleeve and increase its diameter to 2.100 inch. The sleeve was dried in this expanded condition and was removed in this dimensionally stable state from the expanding mandrel. The dry sleeve was readily slipped over a lithographic press dampening roller of 2.055 inch diameter and was wetted with water. The wet sleeve shrunk to conform tightly to the roller surface. Using this covered dampening roller, several thousand impressions were run on a lithographic press with an aluminum offset plate imaged in conventional manner. Comparative runs with cloth covered rolls showed that the non-woven covering remained cleaner and more lint free and permitted better control of the water applied to the plate; cleaner copy is therefore possible. Similar results were obtained with a seamless non-woven sleeve of about 80 weight percent cellulose acetate rayon fibers and about 20 weight percent of substantially water insoluble polyvinyl alcohol fibers, using only four wraps of the web, and also with a seamless non-woven sleeve of 50 weight percent cellulose acetate rayon fibers and 50 weight percent of polypyrrolidone fibers (melting point, 265° C.; second order dry transition temperature, 23° C.; wet elongation, 11%). Less satisfactory, though useful, results were obtained with a sleeve of 100 weight percent substantially water insoluble polyvinyl alcohol fibers.

The ease of mounting the seamless non-woven sleeves and of their subsequent removal is outstanding. Because of the uniform density of the sleeves and their resistance to compacting, less adjustment of the water supply from the fountain reservoir is required during actual use, and new sleeves can be used without any significant "break-in" period. When desired, the non-woven sleeves can be readily cleaned with a suitable solvent without removal from the roll.

Various other embodiments of the present invention will be apparent to those skilled in the art without departing from the spirit or scope thereof.

We claim:

1. A dampening roll cover which consists of a seamless, porous, hygroscopic, cohesive, wholly non-woven cylindrical sleeve consisting essentially of hydrophilic materials, said sleeve being comprised of hydrophilic randomly disposed fibers which

(1) are substantially water insoluble at temperatures below about 100° F.,

(2) can be longitudinally expanded when water wetted,

(3) have dimensional stability in the dry expanded state, and

(4) longitudinally contract from the expanded state when wetted with water at room temperature,

said sleeve further being resistant to tearing, abrasion and fiber disorientation when water wetted.

2. The dampening roll cover of claim 1 in which said fibers comprise from about 20 to 100 weight percent of polyvinyl alcohol fibers and from 0 to about 80 weight percent of cellulosic fibers.

3. The dampening roll cover of claim 1 in which said fibers comprise from about 20 to about 80 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and from about 20 to about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

4. The dampening roll cover of claim 1 in which said fibers comprise from about 20 to about 80 weight percent of polypyrrolidone fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and from about 20 to about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

5. The dampening roll cover of claim 1 in which said fibers comprise about 20 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

6. The dampening roll cover of claim 1 in which said fibers comprise about 50 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 50 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

7. The dampening roll cover of claim 1 in which said fibers comprise about 50 weight percent of polypyrrolidone fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 50 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

8. A dampening roll cover which consists of a dry, seamless, porous, hydroscopic, cohesive, wholly non-woven cylindrical sleeve, consisting essentially of hydrophilic materials, said sleeve being comprised of hydrophilic randomly disposed fibers which

(1) are substantially water insoluble at temperatures below about 100° F.,

(2) can be longitudinally expanded when water wetted,

(3) have dimensional stability in the dry expanded state, and

(4) longitudinally contract from the expanded state when wetted with water and room temperature,

said sleeve being rapidly and radially shrinkable when water wetted and further being resistant to tearing abrasion and fiber disorientation when water wetted.

9. The dampening roll cover of claim 8 in which said fibers comprise from about 20 to 100 weight percent of polyvinyl alcohol fibers and from 0 to 80 weight percent of cellulosic fibers.

10. The dampening roll cover of claim 8 in which said fibers comprise from about 20 to about 80 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and from about 20 to about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

11. The dampening roll cover of claim 8 in which said fibers comprise from about 20 to about 80 weight percent of polypyrrolidone fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and from about 20 to about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

12. The dampening roll cover of claim 8 in which said fibers comprise about 20 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 80 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

13. The dampening roll cover of claim 8 in which said fibers comprise about 50 weight percent of polyvinyl alcohol fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 50 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

14. The dampening roll cover of claim 8 in which said fibers comprise about 50 weight percent of polypyrrolidone fibers having a denier from about 0.5 to about 6 and an average fiber length of from about 0.5 to about 2 inches, and about 50 weight percent of cellulose acetate rayon fibers having a denier from about 0.5 to about 3 and an average fiber length of from about 0.5 to about 2 inches.

15. A dampening roll cover which consists of a seamless, porous, hygroscopic, cohesive, wholly non-woven cylindrical sleeve consisting essentially of hydrophilic materials, said sleeve being comprised of hydrophilic randomly disposed fibers of a material selected from the group consisting of polyvinyl alcohol, polypyrrolidone and rayon, which fibers

(1) are substantially water insoluble at temperatures below about 100° F.,

(2) can be longitudinally expanded when water wetted,

(3) have dimensional stability in the dry expanded state, and

(4) longitudinally contract from the dry expanded state when wetted with water at room temperature,

said sleeve being rapidly and radially shrinkable when wetted with water at room temperature and further being resistant to tearing, abrasion and fiber disorientation when water wetted.

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