Patented Mar. 30, 1954

2,673,520

UNITED STATES PATENT OFFICE

2,673,520

PREVENTING OFFSET OF PRINT FROM FRESHLY PRINTED PAPERS

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No Drawing. Application February 9, 1948, Serial No. 7,299

5 Claims. (Cl. 101—416)

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The present invention relates to improvements in the art of printing papers, and more particularly to a method of preventing "offset" of fresh print from a printed paper surface to an adjacent paper surface in contact therewith and/or to prevent the sticking together of stacked or rewound printed paper surfaces.

When coated or uncoated paper is printed by conventional methods as, for example, by the letterpress or lithographic method, the paper is fed to the press as a sheet from either stacks or rolls, printed, and the wet printed paper is either restacked or rewound as rolls depending upon the method of feed. In order to prevent the offsetting of fresh print from the freshly printed paper to an adjacent paper surface during restacking of the sheets or rewinding of the roll and to keep the stacked or rewound printed paper from sticking, it was necessary to run the press at slow speeds so as to allow the ink to dry sufficiently. However, even this was not altogether effective in preventing offset.

Since speed of printing is essential in commercial operations, a method was devised for overcoming this offset problem, which method consisted of inserting "slip sheets" between the printed sheets. These "slip sheets" consisted, simply, of kraft paper of the approximate size of the printed sheet and allowed the fresh print to offset thereon and in effect acted as a blotter. This scheme has a number of disadvantages and only a few need be mentioned: (1) additional personnel and/or machinery is required to insert and remove the "slip sheets" after each printing operation is performed; (2) additional personnel is required to handle, store and use the "slip sheets"; (3) a large quantity of paper in the form of "slip sheets" must be used, and the method is therefore inefficient; and (4) the clarity and fineness of the printed matter is adversely affected even if there is no apparent smudging or running of the ink.

The present invention provides a simple and efficient method of eliminating the offset of fresh print from one printed paper surface to another during restacking or rewinding even where printing is carried out at high speeds and provides the additional advantage of giving a printed paper surface which is clear, substantially unaltered as to touch and free from materials which slough off during use.

One object of the present invention is to provide a simple and efficient method of carrying out the printing and subsequent stacking or rewinding of paper sheets at high speeds and at

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the same time substantially eliminating offset of fresh print from said printed papers to another paper surface in contact therewith.

A further object of the invention is to provide a method of treating freshly printed paper surfaces whereby offset of the fresh print from said paper to another paper in contact therewith and sticking of printed papers which have been stacked or rewound is substantially prevented.

Still further objects and advantages of the invention will appear from the following description and the appended claims.

In carrying out the general practice of the invention, a coated or uncoated paper sheet is fed from a stack or roll through a suitable printing press such as a lithographic press, a letter press and the like where it is printed and is subjected as it emerges from the plates or printing rolls to a finely divided spray or mist comprising water and/or other liquid particles and discrete particles of silica (SiO_2), and is then restacked, or rewound on rolls for subsequent handling. At least 50% of such silica particles which comprise from 1 to 20% by weight of the spray or mist as used herein, have a particle diameter of less than 5 microns and preferably less than 1 micron.

The invention is adapted to be practiced on coated or uncoated papers which have been printed, for example, by lithographic, letterpress and rotogravure methods. However, the invention is particularly directed to the prevention of "offsetting" of fresh prints from a coated or uncoated paper which has been printed with a viscous ink of the type commonly employed in lithographic or letterpress printing and/or for the prevention of offset of fresh print from printed paper containing fairly large solid areas, that is areas which show up as a solid color area, half tone area, black area, gray area or the like.

In a preferred embodiment of the invention a coated or uncoated paper sheet as freshly printed, for example, on a lithographic press or a letterpress, is sprayed as it emerges from contact with the printing plates or rolls with a finely divided spray or mist comprising essentially water and discrete colloidal silica particles wherein the diameter of the average silica particle is less than 1 micron and the silica comprises about 1 to 20% by weight of the aqueous medium from which the spray or mist is generated. The sheet is then stacked with other sheets, printed and treated in the same manner or wound into a roll, without a separate drying operation. When the printed paper sheets are unstacked or unrolled the ink does not offset neither do the sheets stick

together, nor is there any offsetting during the stacking or rolling. Moreover, the print is substantially unaffected in respect to clarity and fineness as compared to the printed sheets as they come from the press.

The spray or mist as employed in the foregoing description is preferably formed by spraying a silica aquasol having silica particles of the average size described above in the form of fine droplets or "mist" from a suitable spray- or mist-forming device as, for example, paint or lacquer type spray guns, insecticide type sprayers, high pressure lacquer spray guns and the like.

One simple criterion for determining the proper size of spray or mist droplets and the necessary distance of the spray orifice from the printed paper surface is to avoid thoroughly wetting the paper sheet per se. Preferably, the wetting action of the spray should be confined to the outer or extreme surface layer of the paper sheet. This can be accomplished by spraying a thin film on the printed surface from which the water or dispersing liquid will substantially evaporate prior to stacking or rewinding the printed paper. In general, it is desirable to adjust the amount of solution, the fineness of the spray droplets and the distance of the spraying orifice from the printed paper surface so that the moisture content of the paper after spraying and before stacking is substantially the same as the moisture content of the paper before it is sprayed.

The silica aquasols which are employable in the preferred embodiment of the invention can be prepared in a number of different ways. For example, they may be prepared as follows: (1) by passing an aqueous solution of an alkali silicate such as sodium silicate through an acid treated ion-exchange material as described in the Bird Patent No. 2,244,325; or (2) by forming a silicic acid sol by the admixture of sodium silicate and sulfuric acid and adding thereto a glycol or substituted glycol such as monobutyl ether of diethylene glycol as described in the Kirk Patent No. 2,383,653; or (3) by the method described in the White Patent No. 2,375,738, which includes first preparing a silica aquagel by reacting an inorganic acid and an alkali silicate, washing the resulting gel with water to remove the salts formed during the reaction, covering the gel with a dilute sodium hydroxide solution, and after removing the gel from the solution, heating the gel, while avoiding evaporation of water, until substantially all of the gel is converted to a sol; or they may be prepared by any other method which yields a silica sol having silica particles of the general specifications hereinbefore described.

The invention also contemplates the use of aqueous or other liquid dispersions which comprises water, alcohol or other suitable liquids or mixtures thereof as a dispersing medium and dispersed therein, finely divided particles of silica aerogel in amounts varying from about 1 to 15% by weight or more. From 50% or more of such silica aerogel particles generally should be less than 5 microns in diameter.

Suitable silica aerogels can be prepared, for example, by first preparing an aquagel by reacting an inorganic acid and an alkali silicate, washing the gel to remove salts formed during the reaction, replacing the water in the gel with a suitable liquid such as ethanol, slowly heating the gel, in a closed system, above the critical temperature of the ethanol and releasing the ethanol in vapor form so as to prevent the disruption of the gel structure. This method is described in detail in the Kistler Patent No. 2,188,007. In order to employ such aerogels they must be subjected to a pulverizing or powdering operation by attrition or otherwise until the size of at least 50% or more of such particles is less than 5 microns. This finely divided aerogel is then dispersed in water or other liquid by vigorous agitation and then preferably utilized before any substantial settling of the silica particles occur.

A further understanding of the invention will be obtained from the following examples which are intended to be illustrative but not limitative of the invention, parts and percentages being by weight unless otherwise specified.

Example I

A silica sol was first prepared by the process described in the White Patent No. 2,375,738 according to the following procedure:

Sixty-eight and one-half pounds of 66° Bé. H_2SO_4 are diluted with 358 pounds of water and charged to a mixing tank. Four hundred and seventy-two pounds of a sodium silicate solution analyzing 8.9% Na_2O and 29% SiO_2 are diluted with 387 pounds of water and added with stirring to the acid solution. The mixture sets to a gel a few minutes after the mixing is completed. After about 16 hours' aging the syneresis liquor is siphoned off and the gel is crushed to approximately one inch lumps. These lumps are washed with a continuous flow of water for 16 hours. The washed gel is then covered with 750 pounds of water containing 0.9 pound of NaOH. After standing approximately 6 hours the excess solution is drained off and the gel is charged to an autoclave. The gel is heated for 3 hours, using steam at 215 pounds per square inch absolute pressure in the jacket of the autoclave. The contents of the autoclave are then blown out and the small amount of residual undispersed gel is removed by filtration.

The resulting silica aquasol was diluted to a 10% silica solids content and then sprayed in the form of a fine mist by a lacquer type spray gun onto a highly calendered, non-absorbent coated paper which had been freshly printed on a commercial sheet fed letterpress using plates containing dense black sections so as to apply a thin coat or film from which the water substantially evaporated prior to stacking. This procedure was employed on subsequent printed sheets of the same type and the sheets were stacked immediately after spraying and allowed to stand for several days. When the individual sheets were removed from the stack there was no sticking of one sheet to another nor had offsetting of the print occurred. The printed sections were smooth, clear and free of any tendency to dust.

Example II

A silica dispersion is prepared by dispersing 10 parts of a silica aerogel prepared as described above and having at least 50% or more particles of a diameter of less than 5 microns, in 90 parts of water. This dispersion is then employed in the same manner for preventing offset as the silica aquasol described in Example I. Freshly printed sheets sprayed with the dispersion do not stick together, neither does the ink offset from one printed sheet to another.

What is claimed is:

1. In a method of printing paper wherein paper sheets are fed to printing means and then stacked or rewound into rolls, the improvement which

comprises treating the freshly printed paper surface with a fine mist or spray consisting of a silica aquasol containing from 1 to 20% silica by weight and characterized by discrete colloidal silica particles having diameters less than 1 micron dispersed in water, prior to stacking or rewinding such sheets.

2. In a method of printing paper wherein paper sheets are fed to printing means and then stacked or rewound into rolls, the improvement which comprises treating the freshly printed paper surface with a fine mist of spray consisting of a dispersion of silica aerogel particles in water, at least 50% of said silica particles having a diameter of less than 1 micron, prior to stacking or rewinding such sheets.

3. In a method of printing paper wherein the paper sheets are fed to printing means and then stacked or rewound into rolls, the improvement which comprises applying to the printed surface layer of the freshly printed paper a colloidal solution consisting of silica and water in the form of a fine spray prior to stacking or rewinding the printed paper, said solution containing from 1 to 20% silica by weight and being applied in an amount sufficient to form a thin film on said surface layer, from which film the water substantially evaporates prior to the stacking or rewinding of said paper, the colloidal silica particles in said colloidal solution having diameters less than 1 micron.

4. In a method of printing paper wherein paper sheets are fed to printing means and then stacked or rewound into rolls, the improvement which comprises treating the freshly printed sheet prior to stacking or rewinding with a fine mist or spray consisting of an aqueous liquid and fine discrete particles of silica selected from the group consisting of colloidal silica particles having a diameter less than 1 micron and silica aerogel particles, at least 50% of said aerogel particles having a diameter less than 1 micron.

5. A method of preventing offset of freshly printed paper sheets which comprises applying to the freshly printed surface of the paper sheet a fine mist or spray consisting of an aqueous liquid and fine discrete particles of silica selected from the group consisting of colloidal silica particles having a diameter less than 1 micron and silica aerogel particles, at least 50% of said aerogel particles having a diameter less than 1 micron, said mist being applied in an amount sufficient to wet only the outer surface layer of the paper, whereby offset is substantially prevented when the printed surface of the treated sheet is brought into contact with another paper sheet.

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