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DEINKING OF PRINTED PAPER

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1 Claim. (Cl. 92—13)

My invention relates to the art of deinking printed paper in which the flotation process is employed to remove the ink particles after having been loosened from the cellulose fiber and filler. By flotation process I mean froth flotation as performed in a froth flotation machine and described in my Patent No. 2,005,742, dated June 25, 1935, entitled Process for deinking paper.

My present invention has for its particular purpose the elimination of all soaps from the macerated stock; because, as I have discovered, the presence of soap prevents the employment of the flotation process successfully.

The deinking of printed paper by flotation process is entirely different than effecting deinking by the washing process. The removal of ink particles from leached, or cooked (which are synonymous terms) macerated waste paper by the washing process requires exactly the opposite condition than required for the flotation process. The washing process requires the dispersion of the ink particles in order to obtain efficient results, and soaps perform that function; thus facilitate the removal of the ink particles together with dirt by washing the macerated stock. On the other hand, the flotation process demands the flocculation of the ink particles and their removal. Since soaps are strong dispersion reagents, their presence in the macerated leached stock must be substantially prevented. This may be done by the proper control of the leaching step as hereinafter described.

The particular object of my invention is to provide an efficient simple process by which such control in the leaching step may be effected.

In the leaching step the loosening of the ink particles from the fiber and the fiberization of the paper mass is accomplished by the aid of an alkaline liquor. Old paper stock contains considerable saponifiable material such as rosin size and linseed oils in the inks. Leaching produces not a single soap but a mixture of soaps.

From a flotation standpoint these soaps may be grouped into three classes: First, soluble soaps, that is soaps completely soluble in water, hence readily removed by draining or filtering followed by washing; second, insoluble, unstable soaps in which there is a higher ratio of rosin or rosin dissolved in soaps. These soaps are easily flocculated or precipitated by burnt lime or equivalent reagent, thus placing them in a condition harmless in the flotation step; third, stable soaps which once formed cannot be sufficiently removed by draining or filtering and washing and

which further are flocculated or precipitated with great difficulty; hence constitute an impediment in the flotation step, therefore their formation in the preparation of the stock for flotation process must be prevented.

A higher recovery is obtained by flotation than by washing. Besides the art of paper making is constantly demanding cleaner and brighter finished products. The flotation process for deinking printed paper employed prior to my improvement herein described, gives approximately a color of 66-68 with reference to magnesia white as a 100% standard. A slightly brownish murky color is also observed in the top layers of the water when the stock settles, which I found to be caused by stable soaps well dispersed. I have discovered that by preventing the formation of stable soaps, together with the substantial removal of the soluble soaps by washing, and the precipitation and flocculation of unstable soaps, the color of the recovered stock can be raised to 73-74% compared with magnesia white, and, furthermore, with greater simplicity in the flotation machine operation, and uniformity in the results.

My process consists in coarsely shredding the paper into small pieces, for example one to three inches square, approximately, and leaching these shreds in a strong, preferably hot alkaline liquor. By the leaching step ink particles are merely loosened but not freed from the paper shreds; the ink particles still cling to the shreds. The shreds are merely put in such condition that the ink particles which they carry may be readily freed by my process. This condition of the paper shreds manifests itself by the feel of a sample taken from the leached macerated paper stock. The paper shreds are not to be defiberized until after removal of the soapy liquors, for if defiberized prior to such removal, then the removal of the soapy liquors by draining or filtering and washing is rendered impracticable for commercial purposes, due to the fact that the filler constituent of paper—usually consisting of china clay and calcium carbonate—tends to form a cake practically impervious to the passage of soapy liquor.

After the leaching step and the removal of the soluble soaps, the shreds may be defiberized to detach the ink particles from the fiber and thus effect their separation from each other. The stock is then ready for conditioning preparatory to the flotation step. The soluble soaps may be readily removed by simple draining and washing without loss of appreciable amounts of paper

fiber. Some insoluble soap is also removed as an emulsion in the drained liquors, but appreciable amounts of insoluble soaps remain and will finally reach the flotation circuit and unless precipitated or flocculated will interfere with the carrying out of the flotation step efficiently. The unstable soaps may be readily flocculated or precipitated by simple means such as conditioning with burnt lime, for example. Flocculated and precipitated soaps do not interfere with the flotation of the ink particles freed from the fiber.

The formation of stable soaps must be prevented in the initial preparation of the stock which may be accomplished by limiting the leaching time of the shreds.

I obtain best results by using for the leach a strong alkaline liquor—equivalent in strength to caustic solution of 1.2° Baumé at 62° Fahr.—preferably used hot—that is with a temperature of 140–208° Fahr. And the leach must be limited to a period of approximately 30 minutes. The reason for limiting the leach to 30 minute periods is, as my experiments have shown, that during such limited period stable soaps are not formed, but if the leaching period be extended beyond 30 minutes, stable soaps are very apt to be formed almost instantly.

Objection may be found in the increase of the strength of the leaching liquor as mentioned, since such would increase the cost if new liquor were used for each treatment; but since the alkali for making up the initial liquor is necessarily in excess of the amount consumed in the leaching process, I find that by draining the shreds after the leaching treatment, and returning the recovered liquor to the leaching bath, the latter may be maintained at proper strength without excessive alkali cost.

The leached shreds must then be thoroughly washed with water, with agitation, to cause the water to permeate into the body of the shreds and displace the soaps. This step must also be limited to approximately 45 minutes, for repeated tests made by me have demonstrated that if this washing step be extended beyond 45 minutes, some stable soap is likely to be formed.

Caustic soda or soda ash may be employed for making the leaching liquor. Caustic soda forms a relatively larger amount of soluble soap than soda ash, but the tendency to form stable soap is greater than with the use of soda ash.

When caustic soda is employed and the leaching time is carefully controlled, as mentioned, followed by draining, and water washing of the leached stock for removal of soluble soap, defiberizing, the leached shreds in suitable appa-

ratus, and conditioning with a suitable flocculating and precipitating agent, then the flotation step will recover a high percentage of fiber and filler, and the de-inked stock will have a brightness of 73% to 74%, compared with magnesium white as 100%. The resulting froths are moderate in volume, easily controlled, and show a characteristic end-point of clear, fragile bubbles, indicating that the ink removal has been completed.

If soda ash is employed under the like conditions, a larger amount of unstable soaps reach the flotation circuit, causing a lower recovery of filler. But the finished product will be 1 to 2 points higher in whiteness, as determined by a colorimeter. Soda ash has less tendency to form stable soaps than caustic soda.

When soda ash is to be used for making up the leaching liquor, the same control as described with respect to the use of caustic soda must be followed, but a larger quantity of soda ash than caustic soda must be employed for making up the leaching liquor. The amount of soda ash used must give a liquor of about 2° Baumé at 66° Fahr.

Precipitation and flocculation of the unstable soaps are always essential, and are readily effected by conditioning 15 minutes or less with calcium oxide (burnt lime), calcium chloride, sodium chloride (common salt), and similar flocculating agents prior to the flotation step. The flocculation of the soaps at the same time flocculates the dispersed ink particles, which are then readily removed by flotation, as described in my said patent.

I claim:

In the process of deinking printed paper comprising leaching of the stock with an alkaline liquor having strength equivalent to 2–4% caustic soda and a ratio of 12–15 parts of water by weight to one part of air-dried paper treated, and removal of the freed ink particles by froth flotation, the improvement which comprises preventing the dispersion of the ink particles due to the presence of soaps, soluble, insoluble, unstable and stable, by limiting the leaching to a period less than 30 minutes, thereby restraining the forming of stable soaps, removing only the soluble soaps by filtering and washing, limiting the washing to less than forty-five minutes, and precipitating and flocculating both these soaps and ink particles, the unstable insoluble soaps, by the addition of burnt lime prior to the separation of the ink particles from the other paper constituents by the froth flotation step.

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