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METHOD OF REMOVING INK FROM AND
BLEACHING PRINTED PAPERWalter S. Crisp, Fulton, N. Y., assignor to
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My invention relates to a method of removing ink from and bleaching printed paper for the purpose of producing a clean white pulp suitable for making new paper and paper products.

5 In all the prior methods of which I am aware, the newsprint or other paper from which ink was to be removed was first de-inked usually by a saponifying agent, and then washed before bleaching. It was usually necessary to perform several
10 de-inking and washing operations before the pulp was thoroughly cleaned and ready to be bleached. These methods have been found to be unsatisfactory because the resulting product was capable of use only in making inferior grades of paper, the cost of its production too great because of
15 the time required and the enormous quantities of water used for the successive de-inking and washing operations. Further, because of the particular chemicals used and because no adequate
20 means were employed for carrying off the carbon particles of the pigment or the vehicle for the ink, these waste products were merely to a substantial extent, diffused through the mass, resulting in a grayish stock which required an excessive and costly use of bleaching agents. Another disadvantage of most of the methods of the prior art is that in order to reduce the time required for de-inking news print or other stock
25 to an extent suitable for commercial practice, it was necessary to heat or cook the stock solution in order to facilitate the action of the de-inking agents.

Among the objects of my invention are to reduce the time required for treating the stock and thereby decrease the cost by carrying on the complete process of de-inking and bleaching the stock
35 practically simultaneously; second, to utilize the residual alkali used in de-inking for the purpose of forming a bleaching agent; third, to effect a large saving in water whereby even in those paper plants, where water is at a premium, the de-inking of printed papers becomes a commercial possibility; fourth, to provide a process of de-inking and bleaching printed papers which may
40 be carried on at normal water temperatures. Further, I have found that certain substances, while somewhat similar in their characteristics, when combined have an unusual effect in facilitating the de-inking operation and permitting the de-inking and bleaching steps to be performed practically simultaneously.

55 In general, my invention comprises subjecting a suspension of the stock to the action of an alkali, preferably while the stock is being shredded in a beater, together with a dissolver for the ink and

the vehicle of the ink, and a flotation oil whereby the carbon particles, the oils and other refuse matter are separated and floated off. An important aspect of my process is that the bleaching of the stock is carried on in the beater, and the residual alkali is reused to form a bleaching agent. Heretofore, this has been impossible in any practical commercial process because the stock was first subjected to usually several de-inking and washing operations before the bleaching agent
5 was added. This was done probably because the particular chemicals employed for de-inking, served when newsprint formed the base of the stock, to fix the natural dyes and with colored papers to fix the artificial dyes whereby it was
10 found necessary, in order to produce a satisfactory commercial product, to first de-ink, then remove the products of de-inking and the chemicals by washing, and then bleach the pulp. By my process whereby the stock is de-inked and
15 bleached practically simultaneously, a considerable saving in time is effected, the amount of water used is reduced to a minimum, a considerable saving in the cost of chemicals is possible, and clean white pulp is produced capable of use
20 in making many grades of paper.

In utilizing my process while the stock together with water is in a beater which may be of any common form known to the art to which this invention applies, an alkali is added, preferably
25 soda ash or caustic soda, although other alkalis such as ammonia, potassium carbonate, potassium hydroxide or triethanol amines may also be employed. A dissolver for ink is added, the most suitable of which I have found to be pyridine. The pyridine apparently serves two functions; first, to dissolve the vehicle for the dye, and second, to some extent to dissolve the dye. A flotation oil, the most suitable for the purpose being
30 pine oil, is also added. The pine oil apparently acts, to a certain extent, as a dissolver, but mostly serves to float off the insoluble dyes, oils and refuse. These two substances, while somewhat similar in their characteristics, appear to have a peculiar action in combination and quickly serve
35 to separate and float off undesirable materials from the stock even when the solution is at normal water temperatures.

After the solvents have been given sufficient time to act, usually about half an hour, the bleach-forming substance may be added directly to the beater. In my process, I utilize the residual alkali to combine with a bleach-forming agent, such as chlorine, to form sodium hypochloride, sufficient chlorine being added to turn
40 45 50 55

the solution slightly acid. The chlorine is preferably added at the bottom of the beater and permitted to bubble up through the stock until absorbed. The time required for bleaching will vary to some extent, with the character of the stock, but under ordinary conditions, at the end of half an hour, the pulp may be carried to a washer and the ink, oils, and other refuse matter floated off, leaving a clean white stock suitable for most practical paper-making purposes.

I have found that the proportions of various substances may be varied somewhat depending upon the character of the stock, the character of the ink and vehicle for the ink, and the character of the water, but in general, the following proportions have been found satisfactory for use with approximately a ton of stock, the stock roughly consisting of 2 to 4 pounds of paper to 100 pounds of water:

	Pounds
Soda ash-----	50
Pyridine oil-----	5
Pine oil-----	5
Chlorine-----	30

Although I have given the above proportions as being suitable for average conditions, it may be said that the amount of soda ash and chlorine should be kept below the point at which the fiber of the paper is attacked and the amount of pyridine and pine oil may be increased or decreased, depending upon the quality of paper desired, a reasonable increase in the quantity of oils in general resulting in a better quality, whiter paper.

I have found in some cases where a low grade of paper is desired, the pine oil and although with perhaps somewhat less effective results the substances named below as substitutes for pine oil may be used alone without the pyridine, but by far, the best results are secured when the pine oil and pyridine are used together. Although pyridine has been found to be best for the particular purpose, certain other solvents for the ink vehicle will have a somewhat similar action, as compounds of pyridine such as tetracarnit; compounds of naphthalene, for example, tetrahydronaphthalene, decahydronaphthalene; phenol and compounds of phenols such as hexahydrophenol, cyclohexanol, cyclohexanone, methalcyclohexano, and cyclohexanol acetate; ethylene glycols such as monoethyl glycol, diethyl glycol and monoethyl ether of diethenol glycol. I have also found that certain substances, while not as satisfactory as pine oil, may be substituted for the pine oil such as crysilic acid and its compounds and phenol and compounds of phenol, as mentioned above. Colored paper with certain dyes, colors fast to oxidizing agents, were found which would not bleach satisfactorily with the use of an oxidizing bleaching agent such as chlorine, and it was found that a reducing bleaching agent, such as sodium hydrosulphide gave better results, especially when an oxidizing bleaching agent was later added.

While I have described a particular process as being satisfactory for use under average conditions, it will be apparent that because of the number of variable factors present variations may be made in the proportions named and while I have named the substances which have been found to be most suitable, certain substances may be substituted for those named which are equivalents and are intended to be included within the scope of the appended claims.

I claim:

1. The process of de-inking paper stock which comprises subjecting a suspension of the stock to the action of an alkali, pyridine and pine oil.
2. The process of de-inking paper stock which comprises subjecting a suspension of the stock to the action of an alkali, a dissolver for ink and the ink vehicle and pine oil.
3. The process of de-inking paper stock which comprises subjecting a suspension of the stock to the action of an alkali, a flotation oil and pyridine.
4. The process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock while in a beater to the action of an alkali, pyridine, pine oil, and then adding a bleaching agent directly to the beater.
5. A process of de-inking and bleaching paper stock before it is washed which comprises subjecting a suspension of the stock while in the beater, to the action of an alkali, a dissolver for the vehicle of the ink, pine oil, and subsequently adding a bleach-forming agent which combines with the residual alkali to form a bleaching agent.
6. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock while in the beater, to the action of an alkali, a dissolver for ink, a flotation oil, and then adding a bleach-forming agent which combines with the residual alkali to form a bleaching agent.
7. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock while in a beater, to the action of an alkali and pine oil, and subsequently adding a bleach-forming agent which combines with the residual alkali to form a bleaching agent.
8. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock while in a beater, to the action of an alkali, a flotation oil, pyridine, and subsequently adding a bleach-forming agent which combined with the residual alkali to form a bleaching agent.
9. A process of de-inking and bleaching paper stock which comprises subjecting the stock to the action of an alkali while the stock is being shredded in a beater, adding an organic dissolver for the ink vehicle, then introducing chlorine into the suspension during the beating operation and subsequently washing the stock.
10. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock to the action of an alkali in a beater, adding a flotation oil and a substance selected from the group consisting of pyridine and its compounds, naphthalene compounds, phenol and its compounds and ethylene glycol and its compounds.
11. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock to the action of an alkali in a beater, adding a solvent for the vehicle of the ink and a substance selected from the group consisting of pine oil, crysilic acid and its compounds and phenol and its compounds.
12. The process of de-inking and bleaching paper which comprises shredding a suspension of the paper in a beater, subjecting the stock while in the beater to the action of an alkali, pyridine and pine oil for a period of approximately half an hour, then introducing chlorine into the solution to combine with the residual alkali to form a bleaching agent, and after approximately half an hour, washing the stock to remove the dyes, oils and refuse matter.
13. A process of de-inking and bleaching paper

which may be carried on with water at normal temperatures which comprises shredding a suspension of the paper in a beater, subjecting the stock while in the beater to the action of an alkali, a solvent for the vehicle of the ink and any one of a group consisting of pine oil, cresylic acid and its compounds, phenol and its compounds, subsequently adding a bleaching agent, and then washing the stock to carry off the dyes, oils and other refuse matter.

14. A process of de-inking and bleaching paper which comprises shredding a suspension of the paper in a beater, with the water at normal water temperatures, adding an alkali and a de-inking agent, and subsequently adding a bleaching agent.

15. A process of de-inking and bleaching paper stock while the stock is being shredded in a beater which comprises subjecting the stock to the action of an alkali, adding a dissolver for the ink and the ink vehicle and a flotation oil and then introducing chlorine at the bottom of the beater and permitting it to bubble up through the stock to combine with the residual alkali to form a bleaching agent.

16. A continuous process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock to the action of an alkali while the stock is being shredded in a beater, adding a dissolver for the ink, and then introducing chlorine while the stock is being continuously beaten whereby to de-ink and bleach the stock substantially simultaneously, and subsequently washing the stock.

17. The process of de-inking and bleaching paper stock which comprises subjecting a water suspension of the stock to the simultaneous action of an alkali, a dissolver for the ink and the ink vehicle, and a flotation oil while beating the mixture, then adding a bleaching agent while continuing the beating, and subsequently washing the stock to remove the dyes, oils and refuse matter.

18. A continuous process of de-inking and bleaching paper stock capable of being carried on with water at normal water temperatures which comprises subjecting a suspension of the stock to the action of an alkali while the stock is being shredded in a beater, adding an organic dissolver for the ink, and then introducing chlorine at the bottom of the beater while the stock is being continuously beaten and permitting the chlorine to bubble up through the stock whereby it is thoroughly distributed therethrough whereby to de-ink and bleach the stock substantially simultaneously.

19. A process of de-inking and bleaching paper stock which comprises subjecting a suspension of the stock to the action of an alkali while the stock is being shredded in a beater, adding an oil solvent for the ink and the vehicle of the ink and then introducing chlorine into the beater which combines with the residual alkali to form a bleaching agent, the de-inking and bleaching being carried on substantially as one continuous process and with water which may be at normal water temperature.

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