

UNITED STATES PATENT OFFICE

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METHOD OF IMPROVING PAPER MACHINE OPERATION

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This invention relates to the manufacture of paper, more particularly to the manufacture of paper filled with alkaline filler.

The principal object of my invention is to provide a method for paper manufacture whereby furnishes containing alkaline filler may be run on the paper machine substantially free from soft lumps.

An important object of my invention is to provide a method whereby both alkaline filler and casein may be used in the same furnish substantially without difficulty from soft lump formation.

A further object is to provide a method whereby coated "broke" in which alkaline filler has been used as a coating constituent and casein as an adhesive may be used in a beater furnish.

A further object of my invention is to produce paper containing casein and alkaline filler in the furnish, which is substantially free from lumps and lump spots.

Other objects and advantages of my invention will become apparent during the course of the following description.

In the manufacture of substantially unsized paper filled with alkaline filler, particularly when old paper stock is one of the fibrous constituents, soft lumps form in the furnish and cause breaks on the paper machine. I have found that this formation of lumps is traceable to the presence in the furnish of casein from "coated broke", and that the trouble from soft lumps may be substantially eliminated in the manufacture of paper filled with alkaline filler by substantially excluding casein from the furnish. However this exclusion is not always feasible or desirable.

I have now discovered a method whereby the manufacture of paper filled with alkaline filler may be carried on substantially free from soft lumps, or at least with only a commercially unimportant number of soft lumps, even in the presence of casein in the furnish. Such casein finds its way into the furnish from the coated "broke" (this term including the coated paper present in clippings,

trimmings, or the like) in the furnish, or from the old paper stock made from old papers possessing some casein bearing constituents, or from circulating mill waters which in turn originally derive their casein from such sources, or even from casein added directly to the furnish.

The method I employ is similar to that which I disclose in my copending applications Serial Nos. 304,171, and 304,174, both filed September 5, 1928, for the elimination of foam in paper manufacture. My method in its preferred embodiment consists in the addition of alum preferably continuously and preferably in solution at the wet end of the paper machine to a mix including fibrous material, casein, and alkaline filler. There may also be present in the mix size, for example rosin size, in an amount of itself insufficient to impart a substantial degree of sizing to the paper if a substantially unsized paper is to be manufactured, or in a greater amount if a sized paper is to be manufactured, and this size may or may not have been previously precipitated in the beater by a size precipitant, such as alum. In the case where alum is originally added to the size in the relatively concentrated mix the action of the alum at the wet end of the paper machine on the size-alum precipitate originally formed is a restorative one. When the size is used without preliminary precipitation such as by alum, the addition of alum at the wet end of the paper machine acts as a precipitant.

An illustrative furnish which may be satisfactorily used in carrying out my invention is:

Materials added in beater

	Pounds
Fibrous furnish, e. g. sulphite pulp and soda pulp, equal parts (air dry weight) -----	1400
Casein containing ingredient (air dry weight) e. g. coated "broke" -----	300
Alkaline filler (bone dry weight), e. g. calcium carbonate magnesium hydroxide -----	300

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Material added proportionately and continuously on dilution

Alum ----- Pounds 40

5 Another furnish which may be used is:

Materials added in beater

Fibrous furnish, e. g. sulphite pulp, soda pulp and old paper stock, equal parts (air dry weight) ----- Pounds 1400

10 Casein containing ingredient (air dry weight) e. g. coated "broke" ----- 300

Rosin size ----- 6

15 Alkaline filler (bone dry weight), e. g. calcium carbonate magnesium hydroxide ----- 300

Material added proportionately and continuously on dilution

20 Alum ----- Pounds 60

Another furnish which may be used is:

Materials added in beater

25 Fibrous furnish, e. g. sulphite pulp, soda pulp and old paper stock, equal parts (air dry weight) ----- Pounds 1400

30 Casein containing ingredient (air dry weight) e. g. coated "broke" ----- 300

Rosin size ----- 60

Alum ----- 100

35 Alkaline filler (bone dry weight), e. g. calcium carbonate magnesium hydroxide ----- 300

Material added proportionately and continuously on dilution

Alum ----- Pounds 90

40 It is necessary as stated above to add the alum at or subsequent to the point of dilution of the stock, as I have found when the alum is added to the stock in concentrated form, and particularly when the concentrated stock is subjected to agitation as is normal in stuff chests, that the effect of the alum is speedily deteriorated, even to the point of complete destruction. I thus add the alum at a point where there is a minimum of intimacy and time of contact of the constituents of the mix, i. e., at the wet end of the paper machine. I have found that agitation even in the dilute state gradually deteriorates the effect of the alum, but as a practical proposition the time that the alum is in contact with the stock in the dilute state prior to its delivery to a web-forming device is insufficient to permit a substantial deterioration of its beneficial action.

60 The furnishes given above are to be considered as illustrative only and not limiting, as I have found that I may carry on my invention with a wide variety of materials used in widely varying quantities and still obtain satisfactory results.

The papers made by my process may be finished as usual as by machine calendering or supercalendering if desired, and if sized, may be used for conversion, e. g. for coating.

70 My method is particularly valuable as it permits the operation of a mill manufacturing both coated paper and alkaline filled paper without the segregation of the coated "broke" into furnishes which do not contain alkaline filler. It also does away substantially with the difficulties and necessity of isolating casein bearing ingredients from alkaline filler furnishes.

80 It also provides a means whereby the "broke" from paper which has been coated with alkaline filler as a coating material and casein as adhesive may be directly used in furnishes containing either alkaline filler, or other filler such as clay, without causing difficulty on the paper machine.

85 As will be apparent to one skilled in the art this is of very considerable importance and results in very material economy and simplification of operation particularly in mills in which alkaline filler is used either as a coating constituent or as a filler or both.

90 In the place of alum I may use with a measure of success certain acidic materials such as sulphuric acid (H₂SO₄), or acid salts such as sodium bisulphate (NaHSO₄), or metallic salts such as zinc sulphate, or other salts of aluminum such as the chloride or the like. Because of economy, however, I prefer to use ordinary alum.

100 In place of rosin size I may use other sizes, such as soaps, for example, the oleates, or any other material derived by treatment with an alkaline substance or the like from material originally of acid characteristics or from material which likewise is of a partly or completely saponifiable nature such for example as saponified beeswax. I may also use other sizing materials such as paraffin emulsions, for example as set forth in my copending applications Serial Nos. 304,170, 304,173, 304,176 and 304,177, all filed September 5, 1928.

105 Where I use the term "alkaline filler", I mean substantially water insoluble filler which when agitated in contact with freshly boiled distilled water, say for an hour, will impart a pH value to such water greater than 7.0, that is, which will be on the alkaline side of the neutral point. Among the fillers included in this group may be mentioned calcium carbonate, of which lime mud from the causticizing process is one form; calcium carbonate magnesium basic carbonate employed in the paper disclosed in my U. S. Patent No. 1,595,416, issued August 10, 1926; calcium carbonate magnesium hydroxide disclosed in my U. S. Patent No. 1,415,391, issued May 9, 1922; and other substantially water insoluble normal or basic carbonates of alkaline earth metals (which expression is herein intended to include magnesium), or

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compounds, double salts, or physically associated mixtures of these with one or more other acid soluble materials of a substantially water insoluble nature.

5 By the term "alkaline filler" I also intend to include fibrous material and/or other material such as paper coating constituents or the like containing one or more compounds of the character referred to, such as "old
10 papers" or similar papers, "broke", or the like.

When I use the word "paper" herein, I use it in the broad sense to include products of manufacture of all types and of all weights
15 and thicknesses, which contain as an essential constituent a considerable amount of prepared fibre and which are capable of being produced on a Fourdrinier, cylinder, or other forming, felting, shaping or molding machine.
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By the term "wet end of the paper machine" I intend to include those instrumentalities employed in paper manufacture by which and/or in which a relatively concentrated paper mix is diluted, and treated, conveyed or fed up to the point of web-formation such as the mixing box, regulating and proportioning devices, riffers, troughs, screens, head boxes, inlets, and the like, including also instrumentalities used in the white water cycle.
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Where I use the expression "soft lumps" I mean lumps which have their origin subsequent to the screening of the stock, being
35 formed in the head box, inlet or the like. These lumps are entirely different, and easily distinguishable by practical papermakers, from slime, i. e. masses of stock usually fermented or decomposed which settle or
40 form on chest and pipe surfaces, and when dislodged work through the screens and on to the wire. Of course, slime also forms in the head-box and inlets after the machine has run for a relatively long period of time
45 without wash-up, but the soft lumps I describe are entirely distinct therefrom and form, and start to give trouble, even within as short a time as several hours after the head-box and inlet have been thoroughly
50 cleaned.

Where I use the word "casein" herein, I use it in the generic sense to include casein and/or compounds or derivatives thereof.

55 While I have described in detail the preferred embodiment of my invention, it is to be understood that the details of procedure, the proportions of ingredients, and the arrangement of steps may be widely varied without departing from the spirit of my invention or the scope of the subjoined claims.

I claim:

1. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material,

casein bearing constituent, and alkaline filler, alum under conditions favoring the minimizing of time of contact of the constituents of the mix, and thereafter making paper therefrom.

2. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler, alum under conditions favoring the minimizing of intimacy and time of contact of the constituents of the mix, and thereafter making paper therefrom.
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3. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
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4. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler, a salt of aluminum at the wet end of the paper machine, and thereafter making paper therefrom.
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5. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler, a metallic salt at the wet end of the paper machine, and thereafter making paper therefrom.
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6. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler, acidic material at the wet end of the paper machine, and thereafter making paper therefrom.
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7. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material including old paper stock, casein bearing constituent, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
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8. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material including sulphite pulp and soda pulp and old paper stock, casein bearing constituent, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
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9. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a

- fibrous mix comprising fibrous material, casein bearing constituent comprising coated broke, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom. 70
- 5 10. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material including 75
10 old paper stock, casein bearing constituent comprising coated broke, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 15 11. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler comprising 80
20 alkaline earth metal compound, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 25 12. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler comprising 85
30 calcium carbonate, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 35 13. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler 90
40 comprising calcium carbonate and magnesium compound, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 45 14. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, and alkaline filler 95
50 comprising calcium carbonate magnesium hydroxide, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 55 15. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, size, and alkaline 100
60 filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 65 16. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, the reaction product of size and alum affected by alkaline filler, an alkaline filler, alum at the wet end of the 105
70 paper machine, and thereafter making paper therefrom.
- 75 17. The method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding to a fibrous mix comprising fibrous material, casein bearing constituent, size in an amount 110
80 insufficient to produce a substantial degree of sizing in the paper, and alkaline filler, alum at the wet end of the paper machine, and thereafter making paper therefrom.
- 85 18. That step in a method of manufacturing paper filled with alkaline filler and containing casein in its furnish, comprising adding 115
90 alum to the paper mix at the wet end of the paper machine.
- 95 19. A papermaking mix ready for delivery to a web-forming device, and capable of running on the paper machine substantially without difficulty from soft lumps, comprising 120
100 fibrous material, casein bearing constituent, alkaline filler, and alum substantially undeteriorated by said alkaline filler.
- 105 20. A papermaking mix ready for delivery to a web-forming device, and capable of running on the paper machine substantially without difficulty from soft lumps, comprising 125
110 fibrous material including old paper stock and coated broke, alkaline filler, and alum substantially undeteriorated by said alkaline filler.
- 115 21. A paper substantially free from soft lumps, comprising ingredients comprising fibrous material, casein bearing constituent, alkaline filler, and aluminum compound.
- 120 22. A paper substantially free from soft lumps, comprising papermaking ingredients comprising fibrous material including old paper stock and coated broke, alkaline filler, and an aluminum compound.
- 125 23. A paper substantially free from soft lumps, comprising ingredients comprising fibrous material, casein bearing constituent, alkaline filler, sizing, and aluminum compound.
- 130 24. A paper substantially free from soft lumps, comprising ingredients comprising fibrous material, casein bearing constituent, alkaline filler, sizing in an amount insufficient to impart a substantial degree of sizing to the paper, and aluminum compound.
- In testimony whereof I affix my signature.
- HAROLD ROBERT RAFTON.