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PAPER MANUFACTURE

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55 Claims. (Cl. 91—68)

This invention relates to the production of sized paper filled with alkaline filler.

The principal object of the invention is to produce sized paper filled with alkaline filler in which the sizing is applied to the paper web.

A further object is to avoid the readjustments in the papermaking process which are required in certain sizing procedures where paper filled with alkaline filler is sized in the pulp mass or prior to web formation.

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

It is a well known fact that the ordinary paper-making procedure of sizing with rosin size in the beater will not serve to size paper filled with alkaline filler.

In my copending application Serial No. 262,030, filed March 15, 1928, I disclose a method of sizing paper filled with alkaline filler by the use of a paraffin emulsion in the pulp mass.

I have also found that sized paper filled with alkaline filler in which paraffin serves as the sizing agent may be made by application of the paraffin to the paper web instead of in the pulp mass, and it is this invention which forms the subject matter of the present application.

The paper produced by my present process is sized, that is, resistant to aqueous writing ink, and is not to be confused with waterproof or so-called paraffin papers in which the paraffin is present in sufficient quantity to impart a translucent or transparent appearance and a water repellent effect. My paper is similar to, and by ordinary observation cannot be readily distinguished from, ordinary sized papers hitherto made by other means, for example clay filled paper sized with rosin size.

In the practice of my invention, a fibrous mix in which alkaline filler is present is fed to the web-forming device of a paper machine, a web is formed, and to this paraffin is applied. The point of application, the condition in which the paraffin is applied, the method of applying the paraffin, the concentration and amount of paraffin to be applied, and other necessary or optional details of my process are fully set forth immediately below.

The paraffin may be applied at any convenient point on the paper machine, either where the web is still in wet condition, e. g. preferably just after the press rolls, or at a point where the water has been substantially removed from the web, e. g. preferably just after the driers. Or the paraffin may optionally be applied to the paper

web subsequent to the paper machine by a separate process.

The paraffin may be applied to the web either as an emulsion preferably aqueous, or as a solution, preferably in an organic solvent such, for example, as petroleum ether or gasoline. An aqueous emulsion may be applied either to the wet or the dry web, preferably to the wet web which may then be dried as usual, but in the case of application to the dry web of course special provision must be made for subsequent removal of the water present in the emulsion, e. g. by passage of the web over driers or by festooning in a hot atmosphere.

In the case of the use of a solution of paraffin in which the solvent is substantially immiscible with water, it is not suitable to apply such a solution to the wet web, but it should rather be applied to the web after the web has been substantially deprived of its water, preferably after the regular driers. In some cases where a solution of paraffin is used it is found to be especially convenient to apply this solution as an independent process subsequent to the paper machine operation. This may suitably be accomplished on a coating or saturating machine in which means is provided for subsequent removal of the solvent preferably by heat.

In any case, the web, after the application of the paraffin, should be subjected to heat sufficient to cause the fluxing of the paraffin so as to distribute it uniformly throughout the web. For instance, if paraffin of 122° F. melting point be employed, the temperature of the sheet should be raised at least to 122° F., and preferably considerably higher. By using a temperature of 212° F. or somewhat above, any commercial paraffin used can be suitably fluxed in the paper. If the web is not subjected to heat sufficient to cause the fluxing of the paraffin, particularly in the case of the use of solutions of paraffin in organic solvents immiscible with water, the sizing imparted will not be uniform, and the surface may possess water repellent characteristics undesirable in certain cases. An alternative procedure, not so generally applicable but suitable in special instances, is to apply the paraffin to a web already containing sufficient heat to accomplish the uniform distribution of fluxed paraffin throughout the sheet. Such heat may suitably be imparted to an already dry web, e. g. such as one coming off the driers of a paper machine, by passing over hot rolls, e. g. extra driers, or through a chamber suitably heated.

In the case of the application of paraffin emul-

sion to the wet web the necessary heating is supplied of course by the subsequent passage over the driers, but where a solution of paraffin is used and this is applied after the final driers, it is necessary to provide means both for the evaporation of the solvent and the heating of the web in order to flux the paraffin. It is obvious that if the boiling point of the solvent be below that of the melting point of the paraffin, the solvent must be substantially completely removed before the fluxing of the paraffin can ensue.

The evaporation of the solvent is suitably accomplished by the application to the paper web of heat or reduced pressure or both, and the fluxing of the paraffin is accomplished by the application of heat, suitably by passing the web, preferably after substantially all the solvent has been evaporated, over a drier or heated roll, or by passing through calenders, or in contact with a roll thereof, sufficiently hot to accomplish the desired result. A similar result may be obtained by passing the web through a heated chamber.

The paraffin may be applied to the web by any of the various known methods for applying liquids to a paper web, such as by passing the web through a trough or vat containing the emulsion or solution, by applying the emulsion or solution by a brush for example a rotary brush, or by a contact roll, or by a supply box on one of the press rolls, or by spraying or the like. The method of application employed in any given instance is that which is best adapted for use at the particular point at which the paraffin is applied, and should be chosen with regard to the particular conditions to be met in any given case, all of which will be apparent to one skilled in the art. For example I have found that the application by a roll is a convenient method for the emulsion, and by a trough for the solution.

The concentration of the emulsions or solutions used depends to a certain extent upon the method of employing them and the point of application. For application by a roll, the emulsions or solutions can be in general more concentrated, but for immersion or spraying it is more suitable to have the emulsions or solutions relatively dilute. An example of a suitable emulsion concentration is 10 per cent. paraffin by weight, and of a solution, 5 per cent. paraffin by weight. I do not however limit myself to these concentrations as they may be widely varied according to circumstances as indicated above and still produce satisfactory results.

The amount of paraffin required for sizing varies somewhat, as will be apparent, with the grade of paper made, its fibrous constituents, the percentage of filler, and the like, but in general the amount used will vary from somewhat under one per cent. up to several per cent. or more, calculated as weight of paraffin on the weight of the paper. Two per cent. paraffin will usually impart a satisfactory degree of sizing and at any event this is a convenient percentage to try in the first place when tentatively adjusting the amount of paraffin to be applied. As the paraffin is preferably applied continuously to the web, suitable means for supplying the paraffin to the applying device, e. g. a pump, should be employed, and the amount of paraffin applied should preferably vary regularly with the paper machine speed, and be adjustable to the various grades and weights of paper run.

By this method of applying a paraffin emulsion or solution to the paper web I have been

able to make satisfactorily sized alkaline filled papers. In certain cases I have found that by the application to the web by suitable means of a small quantity of molten or very finely comminuted paraffin, preferably to the substantially dry web, it is possible to accomplish a somewhat similar result, but owing to the relatively poor distribution of the paraffin through the sheet obtained by such method, I consider the application of paraffin in the emulsion or solution form to be much the more preferable procedure. Of course it is not possible to practice my invention by the passage of the paper web through a bath of molten paraffin such as used in the manufacture of paraffin paper on account of the very large amount of paraffin thereby taken up by the web. Thus where the expression "sized paper" or size filled "paper" is employed in the claims, it is to be construed as excluding from its scope paper which is saturated or substantially saturated with the thermoplastic sizing agent in question. And where in the claims I speak of "applying" thermoplastic material, as to a fibrous web, or "distributing" it therein, either as such or in liquid association, I mean that the quantity thereof so applied or distributed shall be insufficient to result in the production of paper saturated or substantially saturated with the thermoplastic material in question.

It is possible to employ my sizing method for supplying additional sizing effect to a web containing alkaline filler, which web is already partially sized by other methods, and such use of my process falls within the scope of my invention.

In cases where the paraffin emulsion used is of the breakable type, in which the emulsion may be broken by a suitable precipitant thereby releasing or precipitating the paraffin, it is sometimes desirable to employ such a precipitant in conjunction with the paraffin emulsion, preferably by application to the web of a solution of such precipitant subsequent to the application thereto of the paraffin emulsion. An example of such an instance would be where paraffin emulsified with a soap, for example rosin size, is precipitable by a suitable precipitant such, for example, as alum. An emulsion of paraffin made with 20 per cent. rosin size on the weight of the paraffin is suitable although this may be varied within wide limits. Where a paraffin emulsion of the substantially non-breakable type, such as is described in my copending application Serial No. 304,169, filed September 5, 1928, or one made with a substantially water insoluble emulsifying agent, such as is described in my copending application Serial No. 304,176, filed September 5, 1928, is employed, such procedure is unnecessary. It should be noted that a substantially non-breakable emulsion may be used without any special consideration, but in using the substantially water insoluble emulsifier type, due regard must be given to the extra filler content thereby imparted to the paper.

A similar precipitating action may be employed if desired in the case where solutions of paraffin are used, employing as a precipitating agent, for example, a second liquid miscible with the original paraffin solvent, but in which paraffin is substantially insoluble. An example of this is the use of acetone to precipitate paraffin from its solution in gasoline.

It is possible of course to apply an emulsion of paraffin to the web as it is in the process of

formation on the web forming device, preferably after the fibres have been substantially positioned, and whereas I consider such a method to fall within the scope of my invention, I do not however consider it a preferable procedure in the case of paper made on a Fourdrinier machine owing to the fact that if the emulsion is added to the web forming device at an early stage of the web forming process, part of the emulsion gets into the machine white water cycle which is undesirable especially with saponaceous paraffin emulsions; on the other hand, if the emulsion be applied at a later point on the web forming device it is apt to adversely affect the uniformity of formation of the sheet. Hence I prefer to treat the paper web after formation. However, where in the claims I speak of applying material to the "fibrous web", unless the web is specifically qualified as "dry", I mean of course that the word web should include not only the already formed web but also the web in process of formation as it exists at any point on the web-forming device.

I have found that at times it is desirable to apply the paraffin to both sides of the web instead of only to one side. In certain cases, particularly where emulsions are used, this assists in uniformly distributing the emulsion, particularly where the emulsion is applied by means of rolls. Thus two rolls instead of a single roll would be used.

When I speak of paraffin or the like "in liquid association" I mean paraffin or the like either in emulsion form or in solution in a solvent.

When I employ the term "paraffin" herein, I mean paraffin wax, which is solid at ordinary or room temperature. I do not mean to restrict myself only to the paraffin hydrocarbons, but mean to include in this term all the hydrocarbons of a waxy nature substantially unsaponifiable and inert to acidic and alkaline materials under ordinary conditions of temperature and pressure, whether derived from petroleum, shale, lignite, earth wax, or other natural or artificial sources. I do not, however, mean to include in this term material which at ordinary temperatures is of a tacky or a pitchy nature, such as bitumen or asphalt.

In regard to the paraffin used, it is to be understood that either low or high melting point material can be employed. The so-called fully refined paraffin is entirely satisfactory since it does not impart objectionable color to white paper. However, for purposes of economy, it is often desirable to use a less pure material such for example as the material which is commonly known to the trade as semi-refined paraffin scale, containing approximately one-two per cent. of oil and water as impurities, which material gives satisfactory results. Other even more impure paraffin may be used, especially if the color (whiteness) requirements of the finished paper are not too exacting, or if papers, other than white, are to be made.

In place of paraffin, I may use any other thermoplastic material such as resins, waxes, gums and the like, all of which are substantially water insoluble, and where I refer to such material I mean that such material is substantially water insoluble. If white or light colored papers are to be made, the lighter colored thermoplastic materials should be employed. Although I prefer the use of substantially inert thermoplastic materials, I may also use in certain cases thermoplastic materials which are not substantially inert,

for example thermoplastic materials which are partially or wholly saponifiable, such as beeswax for example. In the latter cases such material in the broke from my sized paper filled with alkaline filler when reintroduced into the beater tends to react with the alkaline filler to cause foam, which however may be controlled by suitable means.

As will be apparent from the above, the sizing agents I employ are substantially insoluble in water, and thus where I speak of solvents I naturally mean to confine myself to solvents other than water, although of course as for example with certain water miscible solvents, the use of which I describe herein, there may be present at times in the solvent used a certain amount of water, which water however does not substantially act in the present instance as a solvent. In connection with the word "solvent", I also mean to restrict the word to material which has a sufficiently high vapor pressure, that is to say sufficiently low boiling point, so that it may be substantially removed from the web for example by at least one of the herein described procedures at a temperature which will not be sufficiently high to substantially injure the web.

When I use the word "saponifiable" herein, when referring to thermoplastic material such for example as resins or the like, I mean that the material so designated belongs to that class of materials which is capable of being saponified. I do not mean that the material so designated is in the saponified condition. The term "resin sizing" (i. e. ordinary rosin size) as customarily employed in the art, means rosin soap in which the rosin exists in partially or wholly saponified condition. I exclude from the scope of the term "thermoplastic material" "resin" or "saponifiable resin" or the like as used herein, such resins when they are in the partially or wholly saponified condition, such for example as rosin would be in rosin soap, and include rosin or other resins in the scope of such terms only when such resins are substantially completely in the nonsaponified condition. And where I speak of thermoplastic material, as resin or saponifiable resin, "in liquid association", or in a "solvent" I mean to restrict myself to the case in which the material to be employed as thermoplastic material is present in liquid association or in a solvent substantially completely in the nonsaponified condition.

By 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 fillers 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 United States Patent No. 1,595,416, issued August 10, 1926; calcium carbonate magnesium hydroxide disclosed in my United States 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 compounds, double salts, or other physically associated mixtures of these with one or more other acid soluble materials of a substantially water insoluble nature. 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 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 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.

Where I speak of "substantially removing the liquid content of said web", it is apparent of course that I do not mean to include in said liquid content to be removed from said web such thermoplastic sizing agent as may happen to be present at such time in liquid condition.

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 the invention or the scope of the subjoined claims.

I claim:

1. That step in a method of manufacturing sized paper filled with alkaline filler comprising applying to a fibrous web containing alkaline filler substantially water insoluble thermoplastic sizing material selected from the group consisting of substantially water insoluble substantially unsaponifiable thermoplastic material, and a solution of substantially water insoluble saponifiable thermoplastic material in a solvent, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

2. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable thermoplastic material to a fibrous web containing alkaline filler, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

3. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable thermoplastic material to a fibrous web containing alkaline filler, and subsequently applying heat to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

4. The method of manufacturing sized paper filled with alkaline filler comprising forming a web containing alkaline filler and sizing, and applying additional sizing thereto which is substantially water insoluble and comprises substantially water insoluble substantially unsaponifiable thermoplastic material, said thermoplastic material applied to said web being sufficient in amount to impart sizing effect to said paper.

5. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin to a fibrous web containing alkaline filler, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

6. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin to a fibrous web containing alkaline filler, and subsequently ap-

plying heat to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

7. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin in liquid association to a fibrous web containing alkaline filler, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

8. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin in liquid association to a fibrous web containing alkaline filler, and subsequently applying heat to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

9. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin in liquid association to a fibrous web containing alkaline filler, substantially removing the liquid content of said web, and applying heat to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

10. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin to a fibrous web containing alkaline filler, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

11. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin to a fibrous web containing alkaline filler, and subsequently applying heat to said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

12. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin to a fibrous web containing alkaline filler, substantially removing the liquid content of the web, and applying heat to said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

13. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin in liquid association to a fibrous web containing alkaline filler, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

14. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin in liquid association to a fibrous web containing alkaline filler, and subsequently applying heat to said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

15. The steps in a method of manufacturing sized paper filled with alkaline filler comprising

applying substantially water insoluble sizing material which comprises substantially water insoluble substantially unsaponifiable resin in liquid association to a fibrous web containing alkaline filler, substantially removing the liquid content of said web, and applying heat to said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

16. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material dissolved in a solvent to a fibrous web containing alkaline filler, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

17. The step in a method of manufacturing sized paper filled with alkaline filler comprising distributing substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a fibrous web containing alkaline filler by means of a vehicle comprising a solvent in which said thermoplastic material is soluble, said sizing material distributed in said web being sufficient in amount to impart sizing effect to said paper.

18. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a solvent to a fibrous web containing alkaline filler, and subsequently applying heat to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

19. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material dissolved in a solvent to a fibrous web containing alkaline filler, and subsequently substantially removing said solvent from said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

20. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a solvent to a fibrous web containing alkaline filler, and substantially removing said solvent from the web by the application of reduced pressure to said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

21. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a solvent to a fibrous web containing alkaline filler, substantially removing said solvent from said web, and applying heat to said substantially solvent-free web sufficient to cause the substantial fluxing of the thermoplastic material, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

22. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a sol-

vent to a substantially dry fibrous web containing alkaline filler, and substantially removing said solvent from said web by the application of reduced pressure and heat, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

23. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises paraffin dissolved in a solvent to a fibrous web containing alkaline filler, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

24. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises paraffin in a solvent to a fibrous web containing alkaline filler, and subsequently substantially removing said solvent content of said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

25. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises paraffin in a solvent to a fibrous web containing alkaline filler, and substantially removing said solvent from said web by the application of reduced pressure, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

26. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises paraffin in a solvent to a fibrous web containing alkaline filler, substantially removing said solvent from said web, and applying heat to said substantially solvent-free web sufficient to cause the substantial fluxing of the paraffin, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

27. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises paraffin in a solvent to a substantially dry fibrous web containing alkaline filler, and substantially removing said solvent from said web by the application of reduced pressure and heat, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

28. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises paraffin in a solvent to a substantially dry fibrous web containing alkaline filler, substantially removing said solvent from said web, and applying heat to said substantially solvent-free web sufficient to cause the substantial fluxing of the paraffin, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

29. The step in a method of manufacturing sized paper filled with alkaline filler comprising applying substantially water insoluble sizing material which comprises substantially water insoluble resin dissolved in a solvent to a fibrous web containing alkaline filler, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

30. The steps in a method of manufacturing sized paper filled with alkaline filler comprising

a fibrous web containing alkaline filler, and subsequently applying heat to said web.

38. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble saponifiable resin in a solvent to a fibrous web containing alkaline filler, and subsequently substantially removing said solvent content of said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

39. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble saponifiable resin in a solvent to a fibrous web containing alkaline filler, and substantially removing said solvent from said web by the application of reduced pressure, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

40. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble saponifiable resin in a solvent to a fibrous web containing alkaline filler, substantially removing said solvent from said web, and applying heat to said substantially solvent-free web sufficient to cause the substantial fluxing of the saponifiable resin, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

41. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble saponifiable resin in a solvent to a substantially dry fibrous web containing alkaline filler, and substantially removing said solvent from said web by the application of reduced pressure and heat, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

42. The steps in a method of manufacturing sized paper filled with alkaline filler comprising applying a solution of substantially water insoluble sizing material which comprises substantially water insoluble saponifiable resin in a solvent to a substantially dry fibrous web containing alkaline filler, substantially removing said solvent from said web, and applying heat to said substantially solvent-free web, sufficient to cause the substantial fluxing of the saponifiable resin, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

43. Sized filled paper comprising fibrous material and alkaline filler in substantially intimate association, and substantially water insoluble sizing comprising substantially water insoluble substantially unsaponifiable thermoplastic material.

44. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble substantially unsaponifiable wax.

45. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble substantially unsaponifiable resin. 70

46. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble substantially unsaponifiable gum.

47. Sized filled paper resulting from distributing substantially water insoluble sizing material which comprises substantially water insoluble thermoplastic material in a fibrous web containing alkaline filler by means of a vehicle comprising a solvent in which said thermoplastic material is soluble, and subsequently substantially removing said solvent from said web, said sizing material distributed in said web being sufficient in amount to impart sizing effect to said paper.

48. Sized filled paper resulting from applying to a fibrous web containing alkaline filler a solution of substantially water insoluble sizing material comprising substantially water insoluble wax in an organic solvent, and subsequently substantially removing said solvent from said web, said sizing material applied to said web being sufficient in amount to impart sizing effect to said paper.

49. Sized filled paper resulting from applying to a fibrous web containing alkaline filler a solution of substantially water insoluble sizing material comprising substantially water insoluble resin in an organic solvent, and subsequently substantially removing said solvent from said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

50. Sized filled paper resulting from applying to a fibrous web containing alkaline filler a solution of substantially water insoluble sizing material comprising substantially water insoluble saponifiable resin in an organic solvent, and subsequently substantially removing said solvent from said web, said resin applied to said web being sufficient in amount to impart sizing effect to said paper.

51. Sized filled paper resulting from applying to a fibrous web containing alkaline filler a solu-

tion of substantially water insoluble sizing material comprising substantially water insoluble gum in an organic solvent, and subsequently substantially removing said solvent from said web, said gum applied to said web being sufficient in amount to impart sizing effect to said paper.

52. Sized filled paper comprising fibrous material and alkaline filler in substantially intimate association, and substantially water insoluble sizing comprising substantially water insoluble thermoplastic material, said thermoplastic material being sufficient in amount to impart sizing effect to said paper, said paper being substantially free from compound resulting from the use of precipitant for said thermoplastic material.

53. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble wax, said wax being sufficient in amount to impart sizing effect to said paper, said paper being substantially free from compound resulting from the use of precipitant for said wax.

54. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble resin, said resin being sufficient in amount to impart sizing effect to said paper, said paper being substantially free from compound resulting from the use of a precipitant for said resin.

55. Sized filled paper comprising fibrous material, alkaline filler, and substantially water insoluble sizing comprising substantially water insoluble gum, said gum being sufficient in amount to impart sizing effect to said paper, said paper being substantially free from compound resulting from the use of a precipitant for said gum.

HAROLD ROBERT RAFTON.

CERTIFICATE OF CORRECTION.

Patent No. 2,020,328.

November 12, 1935.

HAROLD ROBERT RAFTON.

It is hereby certified that error appears in the printed specification of the above-numbered patent requiring correction as follows: Page 2, second column, line 18, for "size filled "paper"" read "sized tilled paper"; page 3, second column, line 37, after "material"" insert a comma; page 6, second column, line 2, claim 37, after "web" and before the period insert the comma and words , said resin applied to said web being sufficient in amount to impart sizing effect to said paper; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of January, A. D. 1936.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.