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METHOD OF COATING PAPER WITH HIGH SOLIDS CONTENT COATING MATERIAL

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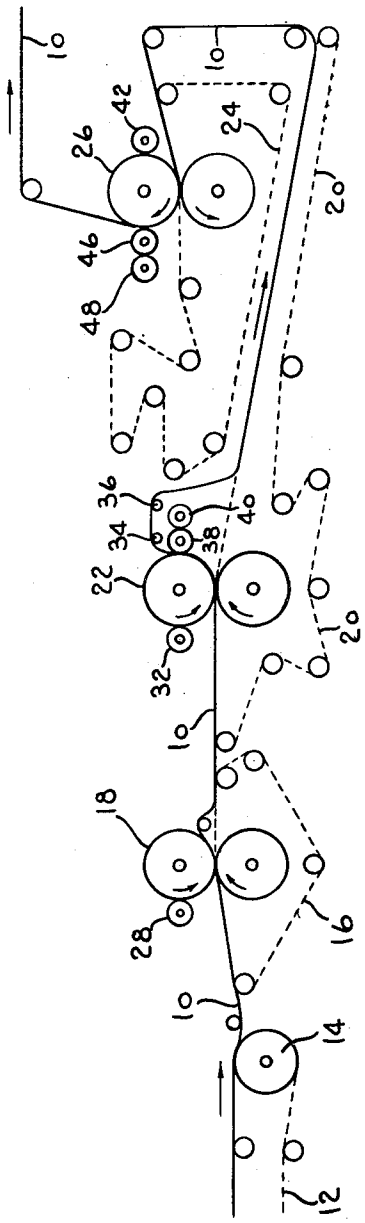

FIG. 1

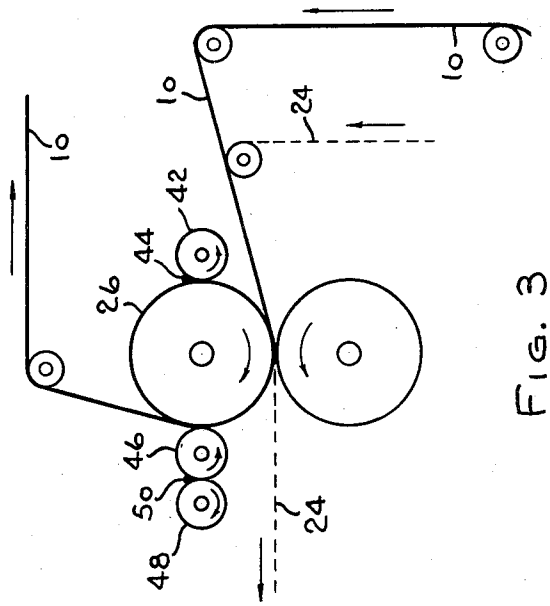

FIG. 3

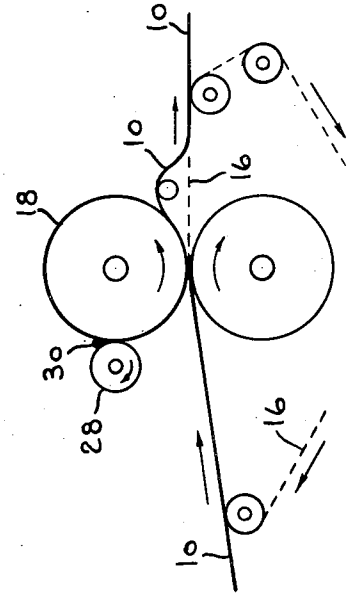

FIG. 2

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METHOD OF COATING PAPER WITH HIGH SOLIDS CONTENT COATING MATERIAL

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1 Claim. (Cl. 92—40)

This invention relates to improvements in the art of paper making and particularly to improved methods of applying paper treating material such as coatings, loading materials, pigments, sizing, and the like.

In applying paper treating material to the web of paper on the customary paper machine, several problems arise. The rapidly moving web (speeds as high as 1000 feet per minute) is carried on various wires, felts, and rollers the speeds of which are controlled and correlated with the speed of the web and with the elongation thereof to prevent undue slack or tension. Any addition of paper treating material to the traveling web must therefore be done by transfer from a rolling surface to the web. However, if a pattern is formed on such rolling surface such pattern will be transferred to the web. Likewise, if paper treating material remains on such rolling surface as such surface parts from the web, a pattern will result from the splitting action of the material remaining on the web and material remaining on such rolling surface. The various methods heretofore used to prevent the finished web from having a commercially undesirable pattern have all had some economic disadvantages. If the treating material is added by the dandy roll while the web is still on the wire (Muggleton Patent No. 2,426,043), there is a low limit on the solids content of such treating material, the use of large quantities of water, and the need to recover treating material which passes through the web at the suction boxes and couch rolls. If pattern dispersing devices are used, such as reversing rolls, doctors, and metering rolls (Muggleton Patents Nos. 2,398,843 and 2,398,844), the additional friction requires more operating power, speeds are lowered, and maintenance costs are increased.

It is the object of this invention therefore to provide an economical method for applying paper treating material to a web of paper without formation of commercially non-acceptable pattern thereon and without use of recovery operations, pattern dispersing devices, and the like. This object is obtained by applying the paper treating material to the web when its water content is sufficient to have a dispersion on the web of any unevenness due to a pattern imparted by the coating roll. If the web has a water content of 80% to 86% and the coating material has a solids contents in excess of the solids content of the web, the web seems to be able "to take" the paper treating material and any pattern transferred from the coating roll or caused by the splitting of the material as the web breaks away from the coating roll levels out and disperses.

The novel features, which are considered characteristic of the invention, are set forth with particularity in the appended claim. The invention, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic view in side elevation of the wet end of a Fourdrinier paper making machine showing the press rolls by which the method embodying this invention is carried out;

Fig. 2 is an enlarged fragmentary diagrammatic view in side elevation of the first press of said machine; and

Fig. 3 is an enlarged fragmentary diagrammatic view in side elevation of the third press of said machine.

The web **10** is formed in the usual manner on the wire **12** of the paper making machine. Upon leaving the couch roll **14** the web is picked up by the felt **16** of the first press **18**. After passing through the press **18**, the web is picked up by the felt **20** of the second press **22**. At this press the web **10** being stronger may be carried over the tops of applicator rolls and again deposited on the felt **20**. Thereafter the web is transferred to the felt **24** of the third or reversing press **26**. As the web leaves the couch roll **14** and is received by the first press rolls **18**, it has a water content of from 80% to 86% and a solids content of 14% to 20%, such solids content may be free of clay or other ash forming content.

At such consistency the web is able "to take" from the upper roll of the first press **18** a film or coating of paper treating material which has a solids content in excess of the solids content of the web and in the range of 35% to 50%. When the web is taking up such coating, any pattern which is imparted from the upper roll or caused by splitting of the material will disperse and become uniform to a sufficient extent so that there will remain in the web no commercially unacceptable pattern. To apply the film of material to a coating roll or the upper roll of the first press **18** there is required only a single smooth roll **28** in rolling engagement with said upper roll to form a nip in which a supply pool **30** of the material may be maintained. As both of these rolls operate without appreciable relative sliding motion therebetween, there is no frictional resistance to retard speed or require additional driving power such as results with the use of pattern removing devices. Such single smooth roll **28** may be added to the press without material or costly structural alterations.

Various kinds of paper treating material may be added to the web by this method. Pigments such as titanium dioxide, sizings such as starch and casein, and loading materials such as clay, may be used singly or in varying mixtures. It is only essential that the percentage of solids content of the material be substantially greater than the percentage of solids in the web and within the range specified. If the percentage of solids content in the material is too low, the web cannot take up the water in the paper treating material because at such stage the web has few, if any, voids. When the solids content of the paper treating material becomes too excessive the material will not be completely removed from the surface of the press roll **18**. When this occurs the pattern tends to become so pronounced that it will not satisfactorily disperse. Therefore, the upper limit of such solids content is attained when the capacity of the web "to take" all the coating material is reached.

During the application of the paper treating material the web may be run within a large range of speeds without making any appreciable difference in the creation of pattern. The important aspect is that the web may be run more easily and with less power and at higher speeds. In fact, the speed of the web may be slightly increased over the customary speed when not adding material because of the presence of the paper treating material on the upper press roll. This helps eliminate pick-up and consequent breakage, thus letting the speed be increased. Speeds as high as 1000 feet

per minute are permissible, the lowest practical speed being in the neighborhood of 350 feet per minute.

The web at the recommended range of 80% to 86% water content should be supported on a felt. It does not have proper tensile strength to withstand breakage and damage when passing through the nips of the first press 18 unless supported by the felt 16. In all paper making machines the web is supported by a felt at the first press and hence no felt need be added. In some paper making machines the lower roll of the first press has a suction box. This may be disconnected when the press is being used to apply paper treating material and thus keep the material from penetrating the web and let it remain on the surface of the web. The use or non-use of the suction at the lower roll of the first press, however, does not affect the operation of this method.

There does not seem to be a critical range of press roll pressures. The normal press roll pressures can be used. Nip pressures in linear inch of face of 72.8 pounds for 22½ pound classified paper, 207 pounds for 54 pound Loxco grade, and 41 pounds for 28 pound Rotolox have been considered normal and found satisfactory for use in this method.

The nature of the solids in the web is not a factor in the operation of this method. So long as the range of solids content is maintained, the solids may comprise fiber, coloring matter, filler, binder, or other materials introduced in the beater. However, with this method additives may be omitted entirely in the beater and the clay or filler required for the ash content added at the first press.

The advantages of applying the paper treating material to the web by the method herein described are: (*a*) a more smooth surface paper results because of permissible orientation of the fibers in the solids content during the application process; (*b*) an increase in tensile strength of the paper by the addition of clay and binder at a point subsequent to the beater; (*c*) the ability to make a high ash paper without adding clay in the beater, thus eliminating wire wear and recovery costs and the limitations placed on ash content by the present method of adding clay in the beater; (*d*) elimination of costly doctors, reversing rolls, metering rolls, and the like; (*e*) elimination of additional power required for operating accessory pattern eliminating devices; and (*f*) increase in traveling speeds of the web and therefore increase in production.

It is within the contemplation of this invention that the paper treating material may be added at the second press 22 by using a smooth roll 32 which functions in the same manner as the roll 28 on the first press.

However, at the second press 22 the tensile strength of the web 10 is higher than at the first press and it is possible for the web to be separated from the felt 20 by guiding rolls 34 and 36 to provide operating space for a smooth coating roll 38 and an applicator roll 40. The coating roll 38 can be used to apply paper treating material to the wire side of the web 10 in much the same limits as applied by the roll 32.

When at the third (reversing) press 36 the solids content of the web 10 is so high that the paper treating material can be applied only if the percentage of solids content thereof is very low. Even when so limited, it is difficult to apply the material without making objectionable pattern, and unless conditions are perfectly balanced it will be necessary to also use pattern removal devices. The means for applying a coating at the third press 26 to the wire side of the web 10 consists of a smooth roll 42 which engages the top roll of the press 26 to form a nip in which a supply pool 44 of paper treating material may be maintained. The top roll of such press is coated with a film of such material and such film is transferred to the web 10 as previously described. If it is desired to apply coating to the top side of the web 10 at the third press 26, a smooth roll 46 runs in engagement with the web 10 and a smooth roll 48 engages the roll 46 to form a nip therebetween in which a pool 50 of such material may be maintained. The application, however, of paper treating material to the web at the third press is in both instances limited to very narrow tolerances of solids content and great care must be taken to prevent the formation of non-commercially acceptable patterns.

Although only one embodiment of the invention is shown and described herein, it will be understood that this application is intended to cover such changes or modifications as come within the spirit of the invention or scope of the following claim.

I claim:

The method of treating paper consisting of passing a web of paper while between 80 percent to 86 percent water content and supported on a felt, between two rolls, the roll in direct contact with the paper having a smooth web contacting surface, applying by a smooth surfaced applicator roll in contact with the roll directly engaging said web a film of paper-coating material having a solids content of between 35 percent to 50 percent to said last-mentioned roll and transferring said film as deposited on said roll to said web.

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