

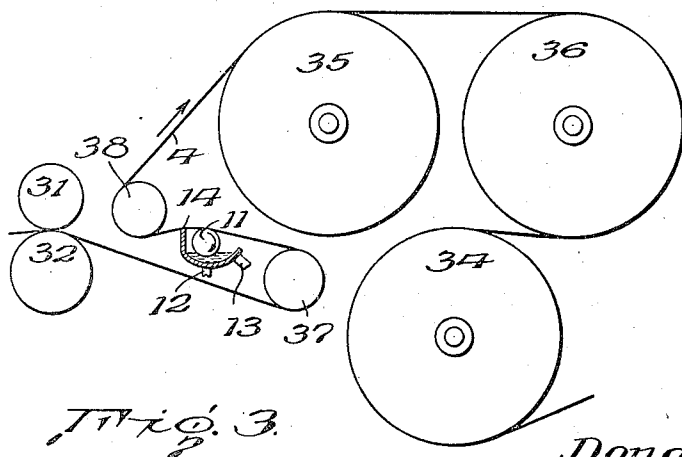
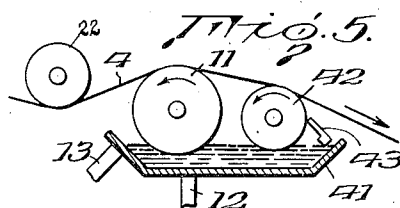
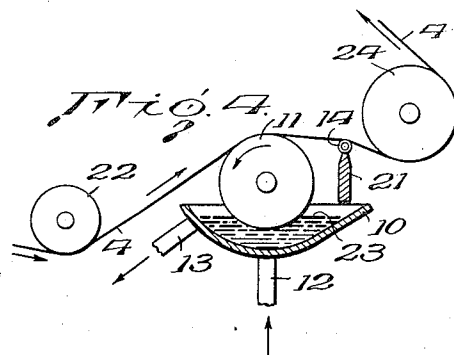
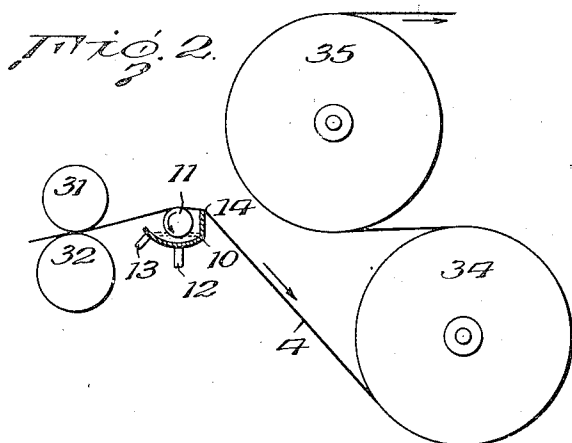
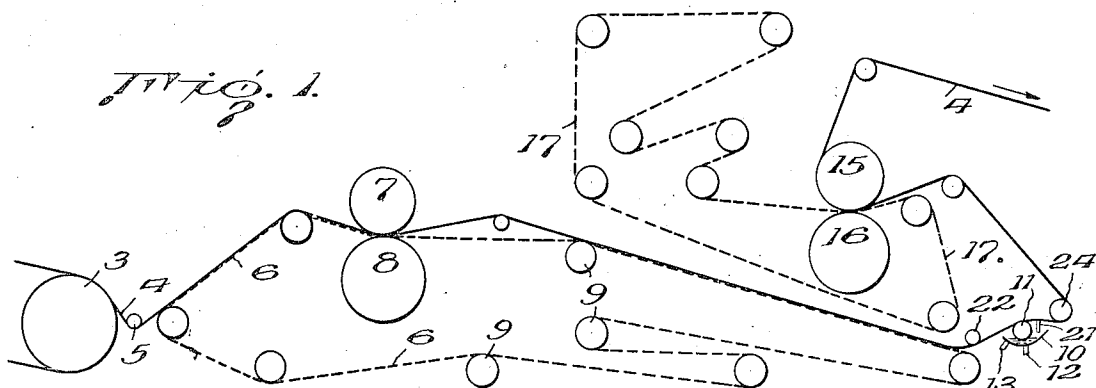
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2,229,620

METHOD OF APPLYING COATING MATERIALS TO PAPER

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2,229,620

METHOD OF APPLYING COATING
MATERIALS TO PAPER

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4 Claims. (Cl. 92-40)

This invention relates to methods of applying coating materials to paper; and it comprises a method wherein a web is formed from an aqueous pulp suspension in one of the usual ways, the wet web is subjected to at least the first of the usual pressing operations, then before the web is subjected to any substantial drying operation which may cause appreciable shrinkage of the web, liquid coating material is applied in excess to the web, excess coating material is removed and the web is dried; further pressing operations sometimes being applied to the web prior to drying; all as more fully hereinafter set forth and as claimed.

In my United States Patent No. 1,913,329 there is described a process of making paper having a filled surface wherein a layer of mineral coating material is applied as an aqueous suspension to a web of paper which has been subjected to at least a partial drying operation and the excess coating is removed down to the upper level of the surface fibers by scraping or blowing. The printing surface of the resulting product contains both fiber and mineral matter; the latter filling inter-fiber depressions, but not covering the face of the paper. The method of filling is simple, and with ordinary care and regulation, is certain in results.

It has been found, however, when the application of the coating material is carried out, as described in my prior patent, at the usual stage of operations, i. e., after the web has been subjected to at least a partial drying operation, that difficulties are sometimes encountered due to the shrinkage of the web which has accompanied the drying. Application of the liquid coating material at this stage can cause a swelling of the web, tending to cause a wrinkling or puckering which can only be prevented by extremely close attention and regulation. Furthermore, the drying and consequent shrinkage commonly take place more or less unevenly across the width of the web. This unevenness serves to accentuate the tendency of the web to pucker, which at times may become so serious as to constitute a major operating difficulty.

Now, I have discovered that, as water is removed from a freshly formed paper web, no appreciable change in dimensions takes place until the retained water in the web is reduced to a certain definite amount which varies somewhat with the particular grade of paper, but is ordinarily found when the weight of retained water is from 1.5 to 2 times the dry weight of the paper. The particular point in the paper machine at which

the web reaches this stage of dryness, and shrinkage consequently begins, varies with the grade and weight of paper being made, the number and kind of wet presses used on the machine, the pressure applied in these wet presses, the number and temperature of drier drums, etc. It is usually found, however, within a short distance after the paper has left the wet press section and entered the driers on the paper machine.

I have discovered that the puckering and wrinkling of the web incident to the application of coating material to a partially shrunken web are overcome by applying the coating to the web before there has been any shrinkage, that is at a location after the web has passed through at least the first of the usual wet presses and before the web has reached the stage of dryness described. After the coating operation, the paper is dried, and shrinkage takes place in the normal manner causing no more difficulty than with a web to which no coating material has been applied. By this means I find it possible to practically eliminate various troubles and wastes formerly incident to the surface filling operation.

The surfacing material may be applied in any convenient way, as by means of a roll engaging the under side of the web and wiping against it to eliminate any bubbles and to insure complete covering of the web with coating. This roll dips into a trough kept supplied with the coating material. A roll driven in the reverse direction to the paper serves the purpose very well though the desired wiping action can also be secured if the roll is driven in the paper direction at a speed sufficiently greater or less than that of the paper. A large excess of coating composition is thus applied all across the web. The greater part of the coating composition, specifically that part which lies above the level of the surface fibers is then removed from the web and returned to the source of supply. This removal may be accomplished by a wiping action, as described in my hereinbefore cited patent, as distinguished from the pressing-in action of press or squeeze rolls, and as further distinguished from removal by suction devices of any kind. One device suitable for removing the excess coating may take the form of a rod mounted on a rigid support and adapted to bear on the paper, in a manner similar to that illustrated in Patent No. 1,944,835 to C. F. Boyers. Another device for the same purpose is a reversely turning roll, advantageously of relatively small radius, wiping against the wet coat-

ing on the web and in turn itself wiped clean before again contacting the paper web.

I have further discovered the surprising fact that in spite of the extremely tender and weak condition of the web in the wet press section of the paper machine, when the web still contains more water than fibers by weight, the application of coating and the drastic treatment incident to removal of the excess, for example, the pulling of the web over a small radius scraper or wiper blade, can be successfully carried out on the web in this state without damage to the web and often even without reducing the speed of the machine. It is a remarkable and totally unexpected fact that this operation can be conducted on even a well filled light weight book paper—an exceptionally tender material at this stage of manufacture—without difficulty and at usual machine speeds.

It is arranged so that the application and the removal of surplus coating material be carried out at a point of contact with press rolls, advantageously after the last press, while the web still contains more water than fiber by weight, and that after the coating has been applied to one side of the web, this side be not subjected to suction, which might tend to remove some of the coating material or suck it out of the surface pores or depressions of the web. Advantageously no suction is applied to either side of the web after the coating has once been applied as this tends to interfere with the desired distribution of the coating material. For these reasons the application of coating and the removal of the surplus are advantageously carried out at a location in the paper machine after the web has passed at least one wet press, after the last suction element, and before any substantial drying of the web has taken place. By suction elements I means suction boxes, or suction rolls, such as the suction couch or press rolls commonly used on the wet end of a paper making machine.

The object of my invention is thus the elimination of the difficulties heretofore encountered in making a filled-surface paper on the paper machine, and the provision of means whereby a paper web can be surface filled on one or both sides in or adjacent to the wet press section of the machine, and whereby this can be accomplished at usual paper machine speeds.

The method of my invention can be carried out by using apparatus such as that illustrated more or less diagrammatically in the accompanying drawing, in which:

Fig. 1 is a diagrammatic view in elevation of the wet press section of a paper making machine showing devices for applying coating material to paper in accordance with my invention.

Fig. 2 is a fragmentary view showing these devices in a different location.

Fig. 3 is a fragmentary view showing the same devices arranged to apply coating material to the upper (felt) side of the web instead of the lower (wire) side.

Fig. 4 is an enlarged view of a portion of Fig. 1 showing the devices for applying coating material and removing the excess, in greater detail.

Fig. 5 is an enlarged view similar to Fig. 4, but showing a modified arrangement for removing the excess coating material.

Referring to Fig. 1, a wet paper web 4 formed in any of the usual ways, is taken off the end of the paper making machine (not shown) at

a roll 9 under a guide roll 5, and on to a first felt 6 which carries it through the first press, which may advantageously be a suction press of known type, comprising rolls 7 and 8. The web is taken off the first felt under a guide roll 22. At this stage it is still very wet and tender, only part of the water having been removed by the first press. The felt is carried on guide rolls 9.

The wet web is now passed over an applicator roll 11 (Fig. 4) advantageously turning in reverse direction, as shown, and supplied with coating material 23 retained in a trough 10. Roll 11 picks up coating material from the trough and distributes it evenly over the web as it passes over the roll. Coating material is supplied to the trough through an inlet pipe 12 and is maintained at a constant level by an overflow pipe 13. Excess coating is now removed from the surface of the web by passing the surface over a rod 14 mounted on a beam 21 as shown. The excess removed flows back into the trough. The web which is now surface filled passes over a guide roll 24 and is taken up on a felt 17. The felt and web pass between second press rolls 15 and 16. The web, still damp, may now be passed between third press rolls if desired (not shown) and thence to driers.

Fig. 2 shows an advantageous modification wherein the coating applying and removing devices are arranged to take the web after it has passed through the so-called felt presses shown in Fig. 1, and a so-called offset press 31—32, and before it passes to first drier drums 34 and 35, in the drier section of the machine. The coating applying and removing device in this location functions exactly as has been described. The location, however, is particularly advantageous because the freshly filled surface is not subjected to a pressing operation which tends to drive the coating material into the web instead of leaving it in the surface depressions to the desired extent.

In Fig. 3 is shown an arrangement which uses the same devices to apply the coating material to the upper or felt side of the web. This can be used independently if desired, or combined with a device for applying coating material to the wire side of the web as shown in Fig. 1 or Fig. 2, so that a web can be treated on either one or both sides as may be desired. The arrangement of Fig. 3 is shown as including additional guide rolls 37, 38. Three of the drums 34, 35 and 36 of the dryer section of the machine are shown in this figure.

In Fig. 5 is illustrated an alternative method by which the surplus coating material may be removed from the web. In this arrangement an excess of the coating or filling material is applied to the web by the roll 11 as already described. The coating material is held in a wider trough 41 instead of the trough 10 as before. In this trough also rotates another, preferably smaller, reversely turning roll 42 which wipes from the web the excess coating material. In order that this roll 42 shall not simply wipe this removed material back onto the web it is arranged to dip into the material in trough 41 which thoroughly wets the surface of roll 42 which is then wiped clean by a rubber, or other suitable doctor blade 43. Roll 42 thus constantly presents a clean surface to the leaving web, which may be thus wiped clean and smooth down to the level of the surface fibers.

By the term "excess" as applied to the coating

material removed I mean the amount of coating material lying above the level of the surface fibres.

As surfacing or coating materials, clay, calcium carbonate, titanium oxide and other mineral pigments may be used in aqueous suspension in combination with adhesives, such as casein, starch, and the like. Either side or both sides of the web may be thus treated. The resulting filled surface paper has improved printed properties and improved color and appearance and the method of manufacture described is simple and economical.

It will be seen from the following example that in my process no addition of rag or other special high strength pulp is necessary to give the web added wet strength at this point, even though considerable proportions of filler be used.

The following example will illustrate the process: A certain book stock paper of such a thickness that 500 sheets of 25 by 38 inches weigh 50 pounds and consisting of soda and sulfite pulp with a fair amount of clay filling, was formed on a Fourdrinier wire at 300 feet per minute. The web was passed through a suction press to remove some water and then, while the web was still wet and before the web was subjected to any drying operation, a large excess of aqueous coating composition was applied to the under (wire) side by means of a reversely turning roll dipping into a trough. This particular coating composition on a dry basis consisted of 90 parts clay, 10 parts finely divided calcium carbonate and 11 parts casein. The total solids in the suspension were 23.5 per cent. The web was then drawn against a small rod mounted on a heavy beam and having a radius of curvature of about $\frac{1}{8}$ inch. The wrap of the paper on the rod was about 20 degrees. The rod removed the excess coating composition, i. e., the coating composition lying above the upper level of the surface fibres, leaving the surface well filled with mineral pigment and adhesive in amount of about 4 pounds per ream (500 sheets) of 25 x 38 inches paper. The paper web, which was still wet, was then passed to the second press, offset press, driers and calenders, in the usual manner. The completed surface-filled paper had improved printing characteristics, color, and appearance.

In another case a coating composition which on the dry basis consisted of 80 parts of clay, 20 parts of finely divided calcium carbonate, and 23 parts of starch, in aqueous suspension comprising 17 per cent total solids, was applied to a paper web between the last wet press and the driers in the manner described. The draw on the web was regulated so that in the dried web the surface was filled with about 2 pounds of pigment and adhesive per ream, which were con-

centrated in the surface depressions of the web.

This application is a continuation-in-part of my prior application Ser. No. 729,341, filed June 6, 1934.

What I claim is:

1. Method of making surface-filled paper which comprises forming a web of paper, subjecting the web while wet to at least one pressing operation, thereafter, in operations separate from any pressing operation, after the last application of suction to the undried web and before any drying, applying aqueous liquid coating material comprising adhesive and pigment in suspension to one surface only of the web, then wiping off that part of the coating material which lies above the level of the surface fibres, thereby leaving on the paper only a small amount of coating material localized in and substantially filling the surface depressions of the web, and thereafter drying the web.

2. Method of making surface-filled paper which comprises forming a web of paper, subjecting the web while wet to at least one pressing operation, thereafter, in operations separate from any pressing operation, after the last application of suction to the undried web and before any drying, applying aqueous liquid coating material comprising adhesive and pigment in suspension to one surface only of the web, then wiping off by means of a small-radius edge that part of the coating material which lies above the level of the surface fibres, thereby leaving on the paper only a small amount of coating material localized in and substantially filling the surface depressions of the web, and thereafter drying the web.

3. Method of making surface-filled paper which comprises forming a web of paper, subjecting the web while wet to at least one pressing operation, thereafter, in operations separate from any pressing operation, after the last application of suction to the undried web and before any drying, applying aqueous liquid coating material comprising adhesive and pigment in suspension to one surface only of the web, then, where the web is not supported on its other side, wiping it over a small-radius edge to remove the coating material which lies above the level of the surface fibres, thereby leaving on the paper only a small amount of coating material localized in and substantially filling the surface depressions of the web, and thereafter drying the web.

4. The method of claim 1 in which the wiping off of the coating material from above the level of the surface fibres is accomplished where the web is not supported on the other side, by a reversely turning roll whose surface is wiped clean before it contacts the coated surface of the paper web.

DONALD B. BRADNER.

CERTIFICATE OF CORRECTION.

Patent No. 2,229,620.

January 21, 1941.

DONALD B. BRADNER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 21, after the word "point" insert --out--; line 39, for "means" read --mean--; same page, second column, line 60, after "web" insert the reference numeral --4--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of March, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.