

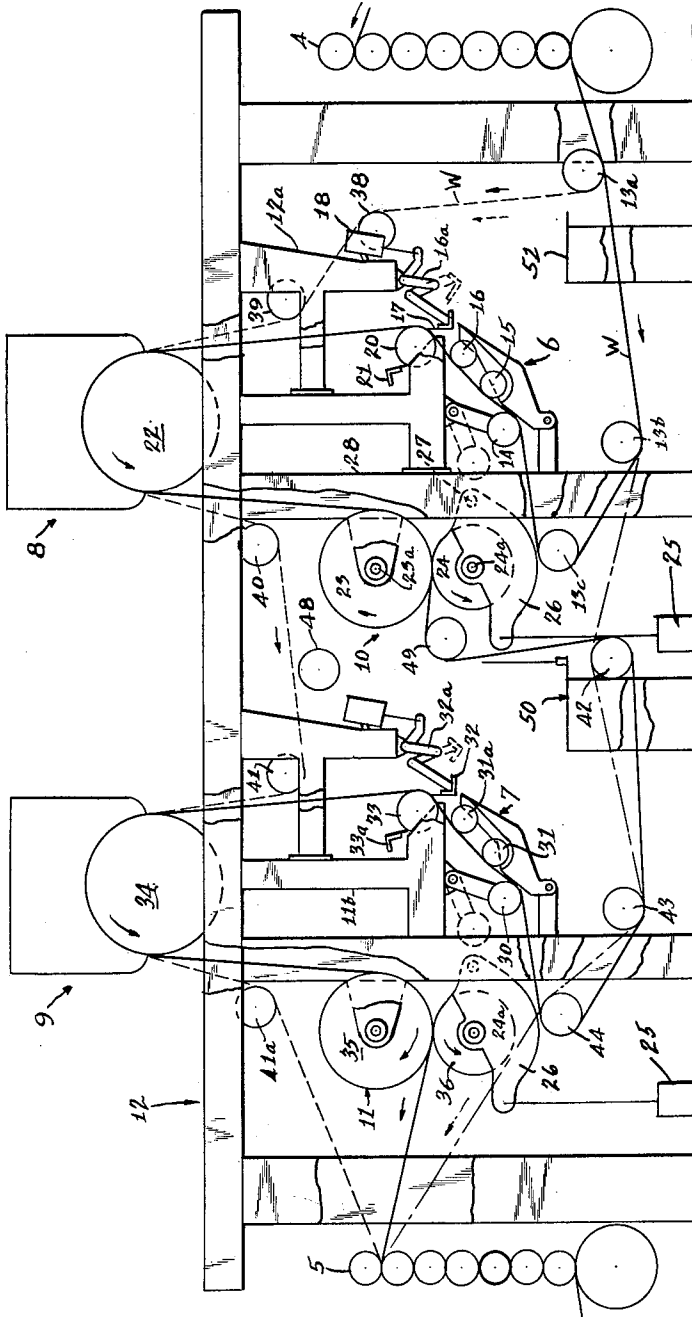
May 14, 1963

R. P. MAHONEY ET AL
APPARATUS FOR SUBJECTING A PAPER WEB TO A VARIETY OF
FINISHING AND/OR COATING TREATMENT

3,089,460

Filed July 13, 1960

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

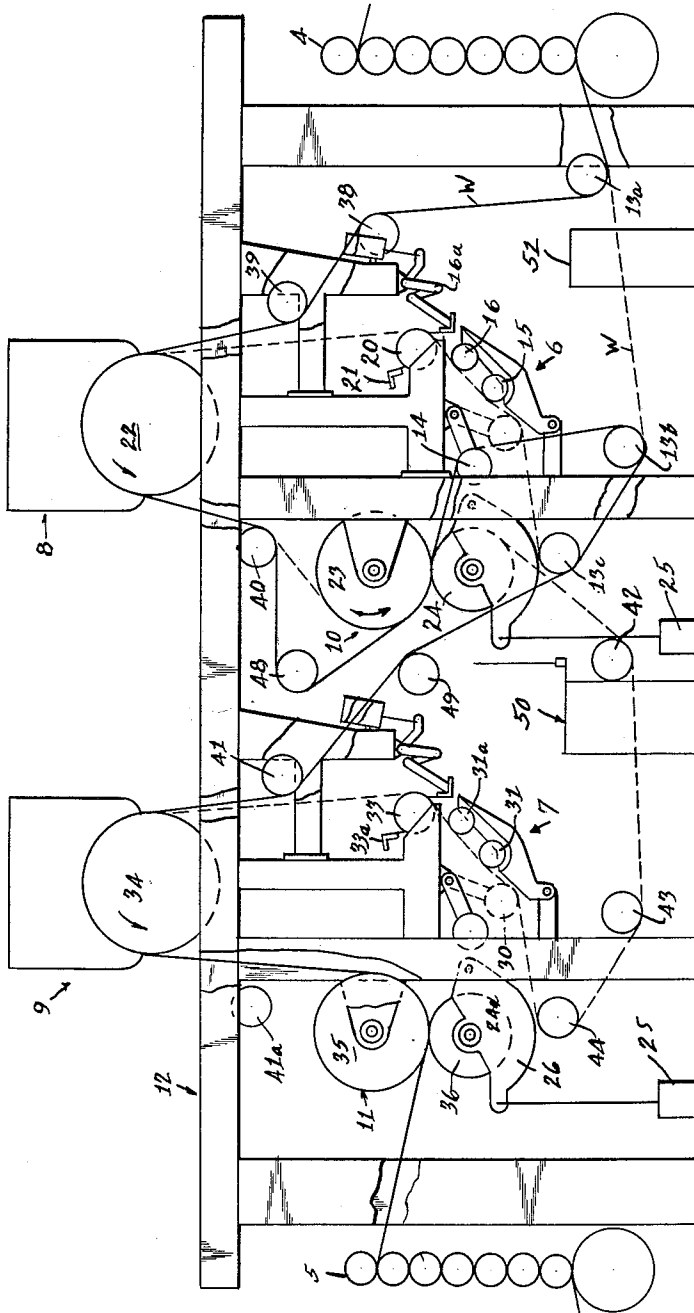


FIG-2

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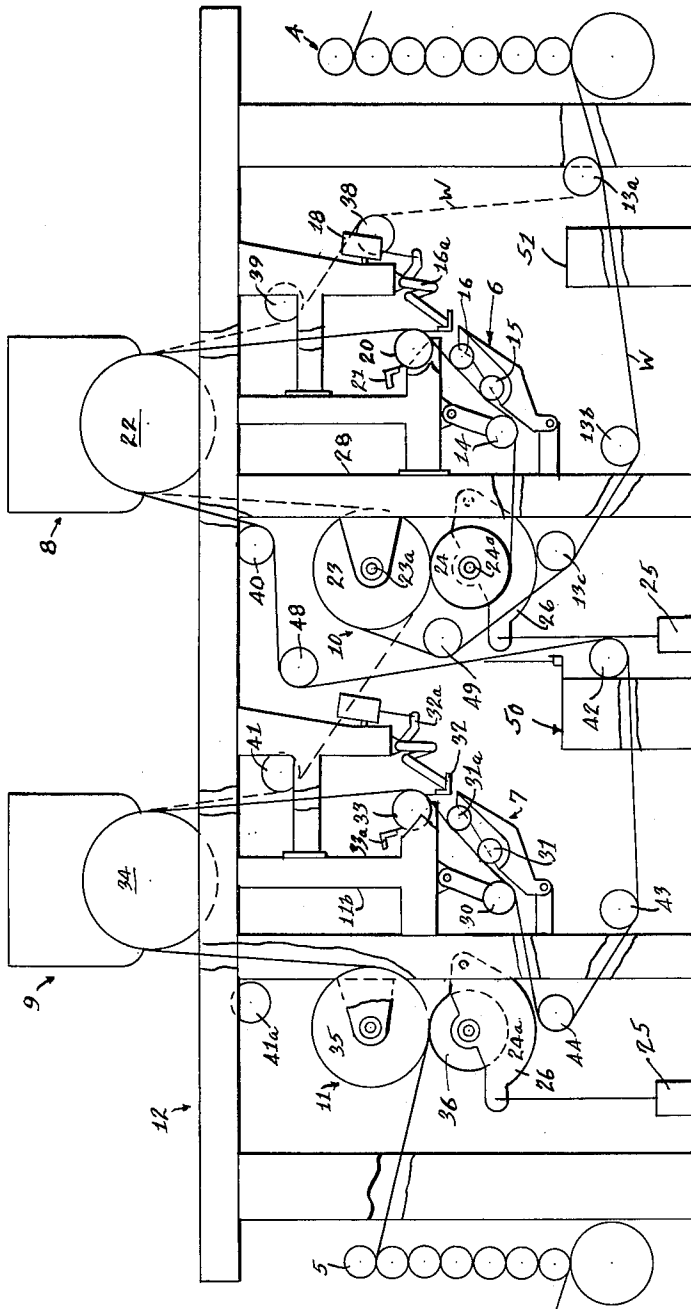
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3 Sheets-Sheet 3

FIG-3



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3,089,460

APPARATUS FOR SUBJECTING A PAPER WEB TO A VARIETY OF FINISHING AND/OR COATING TREATMENT

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This invention relates to finishing of paper web materials and related web materials, and is more particularly directed to improved methods and means for finishing either uncoated or coated web materials.

It has been customary in the prior art to employ smoothing rolls, smoothing presses, calenders and supercalenders in an attempt to impart surface finish to uncoated paper.

Similarly, the desired surface finish for coated paper has heretofore been obtained by divers means of smoothing the wet coating, by drying in contact with a molding surface—known generally as “casting,” or by multiple nip calendering.

The coating finishing operation may involve, among others, calendering or supercalendering of the coated paper under extreme pressure conditions, friction or embossing calendering, brush polishing, or the more recently developed cast coating methods.

Coatings are applied to paper and related web materials for any number of reasons, and, among the advantages obtained thereby, are improvements in printability, gloss, smoothness, opacity, brightness, feel and hiding of the surface of the web. Such coatings basically consist of pigment bound with an adhesive.

Coatings normally include such well-known pigments as barium sulphate, calcium carbonate, calcium silicate, clay, satin white, diatomaceous silica, talc, titanium, etc., and adhesives including, for example, the natural proteins, i.e., casein and soya, animal glue; starch; the synthetic adhesives; the paper latexes, i.e., styrene, butadiene, acrylonitriles, chloroprene, and the polyvinyl acetates. Various pigments and adhesives may be mixed for particular coating applications and may be employed with additional additives, such as setting agents, defoamers, waxes, and the like. Coatings may be applied in a number of layers and the preparation and formulation of these coating colors for paper applications are well-known in the art.

Paper webs may be coated on or off the paper making machine, and various methods and apparatuses for applying coatings to paper webs have been developed, such as, for example, the trailing blade coaters, air knife coaters, roll coaters, dip coaters, brush coaters, spray coaters, print coaters, strip coaters, etc. Many variations in coating processes and in the design of coating apparatuses are well-known in the art.

In addition to on and off the paper making machine finishing of uncoated paper web material and finishing and/or glossing of coated paper web materials, our invention finds particular utility in related applications illustrated by reference to the graphic or printing arts, wherein a coating or “varnishing” process may be performed by the converter after the printing process. Thus, the converter may employ our invention for finishing discontinuous inked or printed and otherwise uncoated paper stock, for finishing continuous inked or printed paper stock which has been coated before the inking or printing operation, and for finishing either discontinuous or continuous coated paper stock which has been inked or printed and then finished and a subsequent coating applied thereto which is then finished in accordance with our invention.

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Our invention finds applicability for both on and off the machine finishing of dried uncoated or dried coated paper, the coating of which has thermoplastic properties including, for example, such paper products as wrapping, bag, tissue, writing, book, newsprint, kraft, board, etc. as well as related applications exemplified above by finishing of inked and/or printed paper products. It is also to be understood that our invention contemplates paper coated on one or both sides in addition to paper having continuous or discontinuous dried coatings.

Each of the foregoing finishing and/or glossing methods, however, have certain inherent disadvantages which prohibit universal application thereof. For example, even though high gloss finishes are obtained, calendering and supercalendering have the common disadvantage of reduction in the bulk or thickness of the paper attributable to the high pressures involved, whereas our invention enhances coating surface characteristics without the “brute force” treatment of conventional calendering. Furthermore, the brightness (or property of reflecting white light) and the opacity of the paper are considerably reduced. Thus calendering has a marked effect on paper density, and, therefore, use of calendered paper stock is limited for printing purposes, first, because the resilience necessary in the printing press nip is reduced by the crushing of the paper in the calendering process and, second, because the ink receptivity of the paper is also reduced.

In the cast coating techniques, the wet coated surface of the web to be finished and dried is brought in contact with the highly polished surface of a metal roll. Because the wet web must be substantially dried before it can be removed from the finishing drum, the drum must be of considerable diameter and the cast coating drying process is therefore quite slow. The web must remain in contact with the forming surface for a period of time sufficient to cause drying of the web in order to assure release thereof without damage to the finish. In addition, the finishing drum, being of considerable diameter, presents problems in transportation, handling, cost, mobility, etc.

For on the paper making machine applications, the apparatus heretofore employed to coat, dry, gloss and/or finish the paper was normally laid out in single-file fashion, and, should it be desired to gloss one or both sides of the paper alternately or coat one or both sides and then gloss one or both sides of the paper alternately, the production line set up soon requires an exorbitant amount of floor space. Furthermore the different treatments required extensive interchange of parts. As far as we are aware no apparatus has, as yet, been developed permitting a wide variety of finishing and/or coating of paper webs and related web materials.

It is therefore among the objects of the present invention to provide improved means for finishing and/or glossing uncoated or coated paper webs and related web materials.

It is another object of the present invention to provide improved means for subjecting a paper web or related web material to a variety of finishing and/or coating treatments.

It is still another object of the present invention to provide improved means for finishing and/or coating one or both sides of a paper material.

A further object of the present invention is to provide means for finishing and/or glossing one coated or uncoated side of a paper web material and for finishing and/or glossing a coated or uncoated side of the same web.

A still further object of the present invention is to provide an improved method for finishing and/or coating web material.

A further object of the present invention is to provide

finishing and/or coating apparatus for paper web material and related web materials which are simple and compact in construction and efficient and high speed in operation.

These and other objects, features and advantages of the present invention will become more apparent upon a careful consideration of the following detailed description, when considered in conjunction with the accompanying drawing illustrating preferred embodiments of our invention wherein like reference numerals and characters refer to like corresponding parts throughout several views.

On the drawing:

FIGURE 1 is a generally diagrammatic view in side elevation illustrating a preferred embodiment of the apparatus constructed in accordance with the principles of the present invention.

FIGURE 2 is a view similar to FIGURE 1 illustrating a number of web runs for subjecting the web to various finishing and coating treatments.

FIGURE 3 is a view similar to FIGURE 1 illustrating other web runs and treatments.

While the apparatus of the present invention, as appears in the drawing, has general applicability and may be employed off the paper making machine, for example, at the finish end of a printing press, the description now to follow will indicate the utility of the apparatus as a component of a paper making machine.

Briefly, the apparatus may be positioned adjacent the paper machine calender, generally indicated by the numeral 4, or optionally may be positioned adjacent the dryer section of the paper making machine.

The apparatus of FIGURE 1 may include, generally, a pair of calenders indicated by the numerals 4 and 5, a pair of conventional coating machines 6 and 7, a pair of conventional dryers indicated by the numerals 8 and 9, and a pair of finishing devices indicated by the numerals 10 and 11. These apparatuses are all shown supported by a frame member 12 and a plurality of guide rolls, as shown, are also employed, as more fully hereinafter explained.

The devices shown in FIGURE 1 cooperate to perform a variety of finishing and/or coating operations on a paper web. The apparatus permits by-passing of the web if finishing or coating is not desired, and, in addition, provides for drying of the web without either one or both of a coating or finishing treatment.

The apparatus of FIGURE 1 is adapted for coating a first side of a web material, drying the first side, and finishing the said first side. The apparatus is also adapted for coating both sides of a web material, drying both sides and finishing both sides. In addition, the apparatus permits drying of one side of the paper web, finishing the uncoated side of the paper web, coating the second side of the web and finishing the second side of the web. The apparatus further permits finishing of one or both sides of the web without a coating step and double finishing of the same side of a coated or uncoated web.

The details of the apparatus will now be discussed in terms of various runs of web material through the apparatus.

FIGURE 1 illustrates three of the various runs through the apparatus. The solid line represents the web "W" run wherein one side of the web "W" undergoes a coating, drying and finishing step and then subsequently undergoes an identical coating, drying and polishing treatment, on the same side of the web. The dash line represents a run wherein the web "W" by-passes the coating and finishing apparatus and is subjected only to a drying operation, whereas the dash-dot run represents by-passing of the web from the coating, finishing or drying apparatuses.

The solid line run of the web, as appears in FIGURE 1, illustrates the web "W" passing over a plurality of guide rolls 13a, 13b and 13c which may be appropriately

mounted on the stanchions of the frame 12. After passing guide roll 13c, the web is guided into contact with the coating machine 6 by an adjustable guide roll 14 and in contact with the furnishing roll 15 of the coating machine. After having been coated, the web is guided over guide roll 16 and, if desired, a traveling blade doctor device 17 may be employed with an adjustable displacement arm 16a operatively responsive to the hydraulic actuator 18 which is mounted on a stanchion cross-arm 12a.

The web is then led around a guide roll 20 which may be provided with a roll doctor 21 and then in contact with the drying roll 22 with the uncoated surface thereof in contact with the drum 22.

Next the web is brought in contact with a heated finishing roll 23 for introduction thereof into a nip defined by the finishing roll 23 and a hard surfaced backing roll 24, resiliently yieldable under pressure. The surface of the finishing roll 23 may be provided with highly polished or smooth finish depending upon the particular type grade paper employed and finish desired. The finishing roll 23 may be constructed so as to have a surface plating of nickel or chrome and may be provided with a conduit 23a for the introduction of a heating medium to the interior thereof.

The backing roll 24 is preferably of lesser diameter than the finishing roll 23 and is constructed of a material which provides a hard, but resilient surface. For this purpose, and in order to minimize the operating pressure loading of the respective rolls, it is desirable that the resilient roll 24 be quite hard, i.e., less than 30 P. and J. (1/8" ball). In the gloss, nip, the resilience of the hard backing roll urges the total area of the web surface being treated into intimate contact with the finishing roll regardless of the presence of minute irregularities in the thickness of the web. With the non-yielding or less yielding surfaces of conventional calenders, the local variations in web thickness do not permit uniformity of finish of the web surface without crushing of the web and disturbance of the natural uniformity or density of the web. Excellent results have been obtained when the nip is of a cross-sectional width less than 1" and preferably about 1/2".

It will be appreciated, of course, that continued use of the nip will tend to cause the resilient or hard rubber surfaced roll 24 to soften slightly due to the temperature conditions existing at the nip and due to the effects of working engagement with the web during operation. In order to maintain the backing roll at the desired hardness level, and, thereby the nip width within desired limits, means may be employed, if desired to cool the resilient roll. For this purpose, a cooling agent may be maintained in the interior of the backing roll introduced through inlet 24a.

The finishing roll 23 having a highly finished surface may be driven by contact with the web "W" as may the backing roll 24 or drive means (not shown) may be provided.

For particular applications and in order to obtain a smooth level finish having excellent ink receptivity and printability, while avoiding the high specular gloss comparable to that obtained by cast coating methods achieved with the chrome or nickel plated or highly polished finishing surfaces, a smooth finished roll may be substituted for the highly finished roll 23.

To vary the pressure applied at the nip for finishing and/or glossing of coating surfaces on webs of different thicknesses, means therefor may take the form of a hydraulically or pneumatically operated piston assembly 25 connected for movement of the support 26 of the backing roll 24 which may be pivotally mounted as at 27 to the stanchion 28. Pneumatic or hydraulic operating pressures then of the piston arrangement need only be increased or decreased in order to produce a corresponding pressure application on the finishing roll and web, depending upon the particular type of paper or board web to be finished

and/or glossed. It will be noted that the surface of the paper web to be finished and/or glossed is brought in contact with the finishing roll.

Therefore, depending upon the particular rheology of the various coating materials employed, simple and effective means may be provided to vary the pressure necessary to blend, smooth and polish the coated surface in the nip.

The finishing and/or glossing apparatus described above has particular applicability for the glossing and/or finishing of dried coated paper having at least its coating predried, plasticized or set and immobile prior to introduction thereof into the finishing nip. The web is dried on the dryer 22 to a commercial or marketable moisture content (usually between 5 and 10% bone dry) and the coating is, therefore, completely plasticized or set and immobile when it leaves the dryer.

The web with its coated surface thus pre-dried and plasticized or set and immobile is now ready to be brought in contact with the finishing roll 23.

The temperatures maintained at the nip in conjunction with the other nip conditions must be sufficient to induce momentarily or temporarily a condition of plasticity in at least the surface of the particular dried, set and immobile coating employed to permit the pressure applied by the backing roll to cooperate in smoothing, blending and finishing and/or glossing the thus plastic coating while in the nip.

Generally the temperature at the nip is maintained above the boiling point of water or other vehicle of the coating and no known upper temperature limits are known to exist other than the decomposition temperatures of the particular coatings and other materials involved. Thus any dried and set and immobile coating composition which may be rendered plastic to the extent set forth in the above described manner may be finished in accordance with the practice of the present invention. Experience has indicated that the transversely and uniformly distributed high intensity unit pressure at the nip is preferably within the range of from about 250 lbs. per square inch to about 2400 lbs. per square inch, depending primarily upon the particular coating and paper web involved.

Thus, in the nip, the pressure and the high surface temperature of the finishing roll induce a condition of temporary plasticity in the previously predried, plasticized or set and immobile coating, particularly in the surface thereof in contact with the finishing roll surface, and impart a finished surface to the coating, while, at the same time, the resilience of the hard surfaced backing roll permits sufficient yielding in the nip to minor web thickness inequalities whereby the bulk and opacity of the web are not materially reduced.

Satisfactory gloss results are obtained at any practical operating speed and, therefore, finishing operating speeds are limited only by the operational speeds of the paper machine itself, or of the web supply means and of the rolls. It will be appreciated that finishing and/or glossing temperatures are generally in direct relation to operating speeds. For example, satisfactory finishing and/or glossing of coated board in the above manner, which was supplied at the rate of 500 ft. per minute, was obtained with finishing roll and nip temperatures of approximately 300° F. and nip pressures of 400 lbs. per linear inch. Similarly, satisfactory glossing results were obtained with a coated light-weight paper running at 2000 ft. per minute through the pressure nip (approximately ½" width) maintained at a temperature of 340° F. and pressures of 400 lbs. per linear inch.

Satisfactory finishing results have been obtained for various coated paper and related web materials with the finishing surface of the finishing roll heated to a temperature within the range of from about 220° F. to about 400° F., while we prefer to employ temperatures within the range from about 280° F. to about 360° F.

In general, the heat and pressure in the hard, narrow

nip should be controlled to conform the surface being finished to the surface of the finishing roll without crushing the web and under conditions which accommodate removal of the web without disturbing the conformed web surface. Usually tolerable moisture contents are lessened with increases in either nip temperature or nip pressure and enlarged with increases in basis web weight. Thus the temperature, pressure and characteristics of the backing roll, resiliently yieldable under pressure, the finishing roll and the particular type web or coating employed contribute to the finish and/or gloss results obtained.

Service walk-ways 50 and 51 may be employed for inspection and service.

The coated surface of the web having been finished, the web may then immediately removed from the nip without the necessity for permitting extended contact between the web and the finishing roll and without damage to the gloss or other desirable characteristics of the web coating. It will be appreciated that the coating is only momentarily or temporarily plastic while in the nip and that, upon leaving the nip, almost instantaneously returns to its previous plasticized or set and immobile condition.

The web, upon leaving the nip, is then led over a plurality of guide rolls for introduction thereof, by an adjustable guide roll 30, similar in construction and operation to adjustable guide roll 14, with the finished and/or glossed side of the web brought in contact thereby with a fountain roll 31 and a guide roll 31a of the coating machine 7. A reverse doctor 32 mounted on an adjustable displacement arm 32a similar in construction and operation to the doctor 17 is positioned for contact with the coated side of the web. A guide roll 33 and a roll doctor 33a, similar in construction and operation to guide roll 20 and doctor 21, are also provided. It will be appreciated that the previously coated, dried and finished surface of the web receives the second coating applied by the coating apparatus 7. The web is then led around roll 33 for contacting the uncoated side of the web in contact with the drying drum 34 of the drying machine 9. Thereafter the freshly coated and dried and set and immobile surface of the web is brought in contact with a finishing roll 35 for introduction thereof into a nip defined by finishing roll 35 and a backing roll 36. Finishing roll 35 and backing roll 36 are similar in construction and operation to the finishing roll 23 and backing roll 24 described in detail above and the nip is maintained under similar temperature, pressure and other conditions for web finishing. The web is then removed from the nip and, wound on a reel (not shown).

Thus one side of a web material may be coated, dried and finished and the same side of the web may undergo a second coating, drying and finishing treatment with apparatus embodying our invention.

The second run appearing in FIGURE 1, as shown by the dotted lines, includes the introduction of the web "W" if desired, into the calender 4 and around the guide rolls 13a, 38 and 39 for contact with the drying drum 22 of the dryer 8 and from thence over a pair of guide rolls 40 and 41 for drying of the web on dryer roll 34 of the drying machine 9. The web may then be guided around a roll 41a for introduction thereof into the calendaring machine 5, if desired, and from the calender to a reeler (not shown).

A third variation shown in FIGURE 1 includes bypassing of the coating, drying and finishing devices. The web may be introduced into the calender 4 and around guide rolls 13a, 13b, 42, 43 and 44 positioned so as to guide the web through the run shown by the dot-dash line into the calender 5, if desired.

Referring to FIGURE 2, illustrating the apparatus shown in FIGURE 1, the web may be subjected to additional treatment runs.

As shown by the full line web run "W," the web, if desired, may be introduced into the calendaring device 4, from thence around the guide roll 13a, 38 and 39 for

drying on drum 22 of dryer 8 and thence around the guide rolls 40 and 48 for positioning the web for contact with the finishing roll 23 and introduction thereof between and into the nip defined by the finishing roll 23 and backing roll 24. It will be appreciated that, in this case, the web is introduced from the opposite end of the finishing apparatus 10 and the rolls 23 and 24 move as shown by the arrows in an angular direction reversed from that of the rolls of FIGURE 1. Thus, the particular arrangement of apparatus is adapted to permit finishing of not only one side of the web but both sides of the web. The finishing roll 23 and the backing roll 24 operate under the temperature, pressure and other conditions outlined above in connection with the description of the operation of the solid line run of FIGURE 1 to finish one side of the web. Upon leaving the nip, the web traverses the adjustable guide roll 14 which, for these purposes, is positioned as shown. The web then traverses guide rolls 13b, 13c, 41 and 49 each of which may be conveniently supported for rotatable movement by a clevis (not shown) supported from a cross bar of the stanchion 12. The web is then fed around guide roll 41 for positioning thereof for contact with the drum 34 of dryer 9. After leaving dryer 9 the web is then brought in contact with the finishing roll 35 for introduction thereof into the nip defined by finishing roll 35 and backing roll 36 for finishing of the other side of the uncoated web under nip conditions similar to those above described. Thus, both uncoated sides of a paper web may be finished with the arrangement of the apparatus shown in the drawing.

For finishing of uncoated webs, the moisture content thereof is preferably within the range from about 15% to zero percent or atmospheric moisture content.

With uncoated webs, the temperature, pressure and other conditions maintained at the nip blend, smooth and plasticized the fibers of the web, and the resilient backing roll yields at minor web inequalities, thereby permitting a smooth surface finish to be obtained when the web is removed from the nip. The conditions of temperature and pressure maintained at the nip are similar to those employed for finishing of coated paper as is more fully set forth above.

The apparatus permits not only finishing of both uncoated sides of a paper web but also coating of one side of a paper web, drying of the coated side, glossing of the uncoated side, recoating of the coated side, drying of the newly coated side and glossing of the newly coated side, as shown by the dotted line run in FIGURE 2.

As shown by the dotted line run of FIGURE 2, the web is guided over the rolls 13a, 13b and 13c, and adjustable guide roll 14 is then positioned, as shown for contacting one side of the web for coating thereof with the fountain roll 15 and for contacting guide rolls 16 and 20. The web is then led around the drum 22 of the dryer 8, and the guide roll 40 is positioned for bringing the web in contact with the finishing roll 23 of the finishing device 10 for introduction thereof into the nip defined by finishing roll 23 and backing roll 24. It will be appreciated that the uncoated side of the web is finished in the nip defined by the backing roll 24 and finishing roll 23. The web may then be permitted to remain in contact with the backing roll 24 and is guided over rolls 42, 43 and 44. The adjustable guide roll 30 is positioned, as shown, to permit recoating of the coated but unfinished side of the web by the fountain roll 31. The now freshly coated web is guided around roll 31a and 33, and the web is then brought in contact with the drying drum 34 of the dryer 9. Upon the web leaving contact with the drum 34, the newly coated side of the web is brought in contact with the heated finishing roll 35 for introduction thereof into the nip defined by heating roll 35 and the hard backing roll 36 for finishing of the newly coated side of the web. Thus, both sides of the web may be dried, one side of the web receive a double coating and both coated and uncoated sides of the web finished on

the apparatus of the present invention which permits reverse movement of the finishing and backing rolls 23 and 24 respectively to achieve finishing in this manner.

As appears in FIGURE 3, the apparatus also permits double finishing of one side of an uncoated web by bypassing the coating devices. The web "W" shown by the dotted lines may be introduced from the calender 4, if desired, over guide rolls 13a, 38 and 39 from which it is brought in contact with the drying drum 22 of the dryer 8. Upon leaving contact with the drying drum 22, the web is then brought in contact with the finishing roll 23 for introduction thereof into the hard, narrow nip defined by finishing roll 23 and hard surfaced backing roll 24. The web is removed from the nip and guided around roll 41 for contact thereof with the drying drum 34 of the dryer 9. Upon leaving contact with the drying drum 34, the web is then brought in contact with the finishing roll 35 for introduction thereof to the hard narrow width nip defined by the finishing roll 35 and the backing roll 36. It will be appreciated that the same side of the uncoated web is finished in both finishing devices 10 and 11. Upon leaving the nip the web may be removed and wound on a reel (not shown). The temperature, pressure, and other conditions maintained at the nip are similar to those described above in connection with the description of FIGURE 1.

Thus it will be appreciated that the finishing rolls 23 and 35 and their respective backing rolls 24 and 36 are adapted for either clockwise or counterclockwise rotation depending upon the side of the web to be finished and the subsequent desired treatment of the finished and unfinished sides of the web.

A further treatment which the web may undergo on the apparatus shown in FIGURE 3 and indicated by the solid line is that of finishing an uncoated side of the web, coating of the finished side of the web by coating machine 6, drying the web on dryer drum 22, subjecting the coated side of the web to a second coating treatment with coater 7, drying of the web and finishing of the coated side of the web in the nip defined by finishing roll 35 and backing roll 36.

Thus it will be appreciated that the apparatus described herein and constructed in accordance with our invention employing small diameter finishing rolls and complementary backing rolls provides a compact means for performing a variety of coating and finishing operations in a single arrangement requiring a minimum change in relative position of parts. Only the adjustable rolls 14 and 30 and the reverse trailing blade coaters 16 and 32 need be moved from their relative coating positions in order to permit finishing of uncoated surfaces of the web. Additionally, if other type coating devices are employed, it is necessary only to move the adjustable guide rolls 14 and 30 to a second position for performing a guide function for finishing uncoated paper surfaces.

Although various minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. An assembly for treating a traveling paper web being received from a source, comprising a lower web coater unit, an upper hot roll dryer unit adapted to apply drying heat to the web passing therethrough, a web finishing unit formed of a hard surfaced finishing roll connected to means for heating the same and a resiliently yieldable roll defining a pressure nip with the finishing roll for receiving the web, said units being positioned closely together and generally at the apexes of a triangle, a trio of upper web guide rolls above the coater unit and below the dryer unit, a trio of lower web guide rolls below the coater unit, and a trio of web guide rolls positioned inter-

mediate the upper and lower trios, whereby the web may be guided from the source through said units.

2. An assembly for treating a traveling paper web being received from a source, comprising a lower web coater unit, an upper hot roll dryer unit adapted to apply drying heat to the web passing therethrough, a web finishing unit formed of a hard surfaced finishing roll connected to means for heating the same and a resiliently yieldable roll defining a pressure nip with the finishing roll for receiving the web, said units being positioned closely together and generally at the apexes of a triangle, a pair of upper web guide rolls closely spaced from and operatively associated with the dryer unit, a pair of lower web guide rolls below the coater unit, and a pair of web guide rolls positioned intermediate the upper and lower pairs, whereby the web may be guided from the source through said units.

3. An assembly for treating a traveling paper web being received from a source, comprising a lower web coater unit, an upper hot roll dryer unit adapted to apply drying heat to the web passing therethrough, a web finishing unit formed of a hard surfaced finishing roll connected to means for heating the same and a resiliently yieldable roll defining a pressure nip with the finishing roll for receiving the web, said finishing unit being closely spaced from and at substantially the level of said coater unit and said dryer unit being positioned closely above and between the finishing and coater units, said units being positioned closely together and generally at the apexes of a triangle, a trio of upper web guide rolls above the coater unit and below the dryer unit, a trio of lower web guide rolls below the coater unit, and a trio of web guide rolls positioned at the level of the finishing and coater units and below the upper trio, whereby the web may be guided from the source through said units.

4. An assembly for treating a traveling paper web being received from a source, comprising a lower web coater unit, an upper hot roll dryer unit adapted to apply drying heat to the web passing therethrough, a web finishing unit formed of a hard surfaced finishing roll connected to means for heating the same and a resiliently yieldable roll defining a pressure nip with the finishing roll for receiving the web, said finishing unit being closely spaced from and at substantially the level of said coater

unit and said dryer unit being positioned closely above and between the finishing and coater units, a pair of upper web guide rolls closely spaced from and operatively associated with the dryer unit, a pair of lower web guide rolls below the coater unit, and a pair of web guide rolls positioned intermediate the upper and lower pairs, whereby the web may be guided from the source through said units.

5. In combination, a plurality of successive assemblies for treating a traveling paper web being received from a source, each assembly comprising a lower web coater unit, an upper hot roll dryer unit adapted to apply drying heat to the web passing therethrough, a web finishing unit formed of a hard surfaced finishing roll connected to means for heating the same and a resiliently yieldable roll defining a pressure nip with the finishing roll for receiving the web, said units being positioned closely together and generally at the apexes of a triangle, a trio of upper web guide rolls above the coater unit and below the dryer unit, a trio of lower web guide rolls below the coater unit, and a trio of web guide rolls positioned intermediate the upper and lower trios, whereby the web may be guided from the source through said units in each of said assemblies.

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