

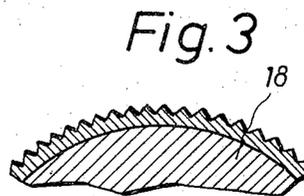
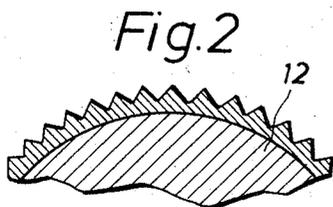
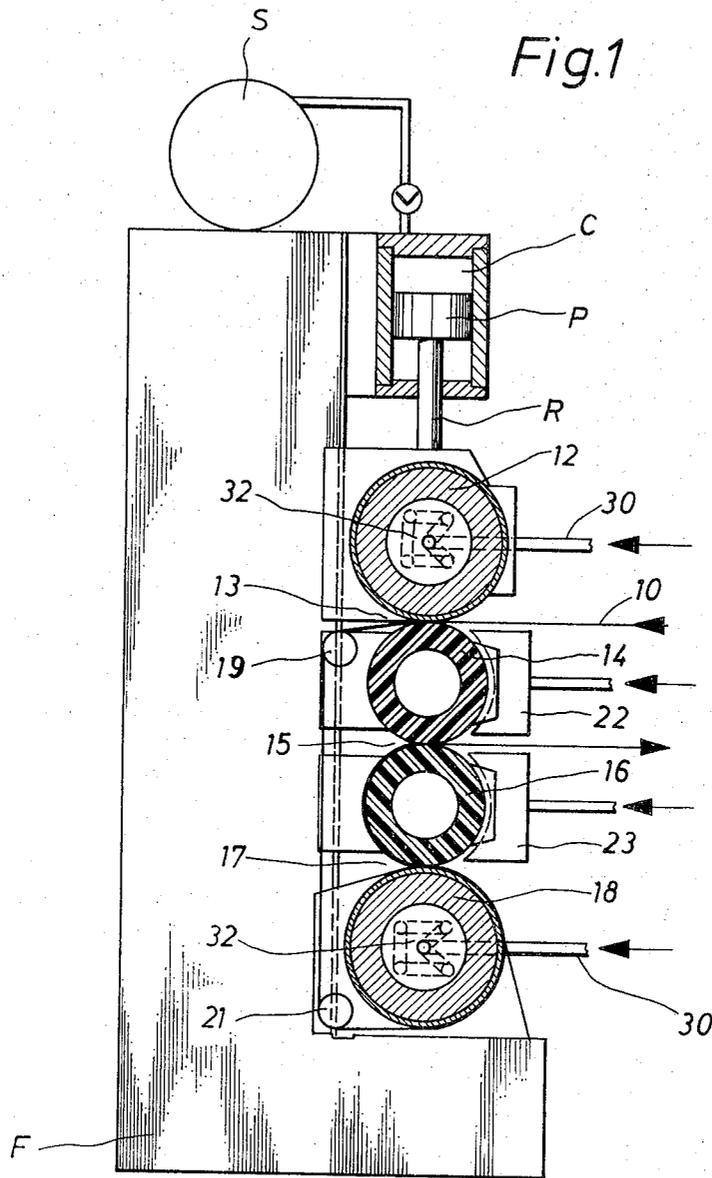
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APPARATUS FOR SATINIZING FIBROUS WEBS

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**APPARATUS FOR SATINIZING FIBROUS WEBS**  
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 nwebers Industrie-Companie Gesellschaft mit besch-  
 rankter Haftung

Continuation-in-part of application Ser. No. 160,217, July  
 6, 1971, which is a continuation of application Ser. No.  
 878,772, Nov. 21, 1969, both now abandoned. This  
 application May 3, 1973, Ser. No. 356,745

Int. Cl. B30b 3/04, 9/100; D21a 1/00

U.S. Cl. 162—362 9 Claims

### ABSTRACT OF THE DISCLOSURE

An apparatus for satinizing fibrous webs including a  
 first satinizing roll having a relatively hard and rough  
 surface and a first backup roll in first nip defining relation-  
 ship with the first satinizing roll and having a resilient  
 smooth surface. In addition, a second satinizing roll and  
 a second backup roll for a second nip is employed. Web  
 feeding rolls are positioned to feed a web first through  
 the first nip and thereafter through the second nip where-  
 by the web is satinized.

This is a continuation-in-part of application of co-  
 pending Ser. No. 160,217, filed July 6, 1971, now aban-  
 doned, which was a streamline continuation of original  
 application Ser. No. 878,772, filed Nov. 21, 1969, now  
 abandoned, both belonging to the assignee of the present  
 invention and predecessors thereof.

### BACKGROUND OF THE INVENTION

The present invention relates to a satinizing device,  
 such as a paper calender, wherein sized papers such as  
 those used in the printing and related processes so that a  
 dull effect on the paper is produced. Such a dull effect on  
 the paper improves the quality and pictorial effect of the  
 printing when compared with high gloss papers.

The prior art attempts to achieve the dull surface on  
 paper was first centered about a process wherein the web  
 was passed between two paper rolls. Because the rolls  
 very rapidly became smooth and hard and thus lost the  
 dulling effect, these paper rolls were reroughened by hav-  
 ing cast metal rolls being pressed against them. Eventually,  
 the prior art resorted to the production of dulled paper  
 and other webs by direct pressure of a roughened cast or  
 steel roll against the paper web.

None of these processes achieved a great degree of  
 commercial success because of the deficiencies with which  
 they are afflicted. Rough paper rolls form an abrasion  
 which quickly deteriorates the paper shell due to the con-  
 stant reabrasion. Large quantities of dust must be col-  
 lected and removed, which presents a substantial problem  
 for that type of a device. The same phenomenon also oc-  
 curs with calenders where the dulling is accomplished by  
 cast or steel rolls, and this occurs at the roll ends not  
 covered by the paper web. It has also been found that  
 in the case of two sided dulling, where the material web  
 must discharge between two relatively elastic rolls, the  
 dulling embossed by the metal rolls is eliminated partially,  
 and due to the nonhomogeneous nature of paper rolls, an  
 irregular glossy effect or marble effect is noted. It has  
 generally been found to be impossible to simultaneously  
 achieve an adequate dulling effect while also maintaining  
 the smoothness and uniform paper thickness and other  
 qualities which is necessary in quality printing.

Accordingly, it is an object of this invention to provide  
 a device which is satisfactory for satinizing or dulling the  
 surface of paper and other webs to permit the creation  
 of uniformly dull paper which is yet smooth and uniform  
 in quality.

It has now been discovered that a proper apparatus for  
 satinizing fibrous webs may be provided. Basically, this  
 device includes a first satinizing roll, having a relatively  
 hard rough surface. In a first nip defining relationship  
 with this first satinizing roll is a first backup roll which  
 has a resilient smooth surface. A second satinizing roll  
 and a second backup roll form a second nip in the same  
 manner. The web feeding means is adapted to feed the  
 web first through the first nip and thereafter through the  
 second nip. In this manner, the web is properly satinized  
 without material effects on the uniformity, smoothness,  
 and other properties of the paper. The satinizing rolls are  
 metal or steel rolls and are provided with a dull emboss-  
 ing and the paper guide is such that the steel rollers di-  
 rectly emboss the dulling upon the paper web. Although  
 even in this arrangement with bilateral embossing the  
 paper web provided with the dulling must discharge be-  
 tween both plastic rollers, that is the two dulled surfaces  
 again are pressed somewhat, the surprising discovery has  
 been made that neither is the dulling dispersed with glossy  
 spots nor does an abrasion form on the ends of the plastic  
 rolls not covered by paper. Undoubtedly, this is caused  
 by the fact that the plastic rolls do not become inhomog-  
 eneous despite the steady compression in the roller  
 joint, and that the high elasticity of the plastic does not  
 permit a formation of abrasion at the exposed ends of  
 the rollers.

In a preferred embodiment, the web feeding means is  
 adapted to feed the web first through the first nip such  
 that one side of the web contacts the satinizing roll.  
 Thereafter, the web feeding means passes the web through  
 the second nip such that the other side of the web con-  
 tacts the satinizing roll. In this manner, both sides of the  
 paper may be treated. In addition, it is also possible ac-  
 cording to the present invention to define a third nip be-  
 tween the first and second backup roll, whereby the feed-  
 ing means is adapted to feed the web through the third  
 nip after passage through each of the first two nips, to  
 render uniformity to the resulting paper product. It should  
 also be noted that the dulling or satinizing of the top  
 side of the paper web or first satinized side is neutralized  
 slightly since it is pressed during the passage the device  
 twice by the elastic roll, while the bottom side is pressed  
 only once. Accordingly, it is a preferred embodiment to  
 provide a first satinizing roll having a slightly more rough  
 surface than the second satinizing roll.

In another embodiment in which all rolls are located  
 one upon another there is noted that at least the rolls are  
 capable of being pressed against each other through pres-  
 sure means exerting force from above in alignment with  
 the axes of the rolls that are in parallel and arranged  
 one above the other in vertical positioning of horizontally  
 extending rolls. Thus, both synthetic material rolls to-  
 gether press upon the web passing through the nip that  
 is considerably more narrow and closer together than  
 that of the previous embodiments. Thereby, the rolls are  
 more effective in exerting a smoothening effect upon the  
 web. This provides an additional option and possibility  
 of either using the arrangement for additional smoothen-  
 ing or only using the arrangement of rolls and not the  
 pressure means without any supplemental smoothening  
 in the nip.

For a more complete understanding of the present in-  
 vention, reference is hereby made to the drawings, in  
 which:

FIG. 1 is a schematic illustration showing one embodi-  
 ment of the present invention, and;

FIG. 2 is a schematic drawing showing the surface of  
 the first satinizing roll having a slightly more rough sur-  
 face than the second satinizing roll;

FIG. 3 is a schematic drawing showing the surface of  
 the second satinizing roll.

As shown in FIG. 1, a web 10 passes between a first satinizing roll 12 and a first backup roll 14. The satinizing roll 12 has a relatively hard rough surface and may be prepared from most metals, and preferably from iron or steel. The rough surface may be achieved in a number of ways, such as by sanding or etching, while a preferred method to provide the rough surface is to subject the surface to the conventional dull chrome plating process.

The backup roll 14 has a resilient smooth surface and may be manufactured from plastics, or other materials which are capable of being formed into resilient smooth surfaces. The term "plastic" is intended to mean those synthetic materials which are formed by polymerization of one or more materials to form either a thermoplastic or thermosetting material.

After the web 10 has passed through the nip 13 defined by the satinizing roll 12 and the backup roll 14, it is guided by web guide means around rolls 19 and 21 to a point where it wraps second satinizing roll 18. The second satinizing nip 17 is formed between the satinizing roll 18 and the backup roll 16. It will be noted from FIG. 1 that the one side of the web is treated at nip 13 while the other side of the web receives a satinizing effect to nip 17. Finally, a web 10 passes through a nip 15 which is formed by the two backup rolls 16 and 14 to insure uniformity of the paper smoothness and thickness.

The first and second backup rollers 14, 16 respectively directly adjoin each other in location intermediate the first and second metallic satinizing rolls 12, 18 with a looping angle amounting to 180° around one backup roll 16 resulting in web exit in a direction substantially opposite to direction of entry thereof.

In this embodiment all rolls are located one upon another and at least the rolls are capable of being pressed against each other through pressure means exerting force from above in alignment with the axes of the rolls that are in parallel and arranged one above the other in vertical positioning of horizontally extending rolls. As illustrated, the bearing means of the uppermost satinizing roll 12 at opposite journalling ends thereof can be subjected respectively to hydraulic pressure exerted by a piston P having a rod H reciprocable with respect to a cylinder C representing pressure means to which fluid under pressure from a source S is supplied to a chamber above the piston P. The pressure means can be arranged to exert force on each side as to the bearing or journalling means for the rotational axis of the uppermost satinizing roll 12 of hard metal with a rough surface as described previously. In addition, the rolls with their own weight engage upon each other and/or additionally the hydraulic or fluid pressure applied to the piston P can maintain such continuous pressure for engagement continuously in close relationship as to the four rolls stacked one above the other. Thus, both synthetic material rolls 14 and 16 together press upon said web 10 passing through the nip 15 that is considerably more narrow and closer together than that of the previous embodiments. Thereby, the rolls 14 and 16 are more effective in exerting a smoothening effect upon the web 10. This provides an additional option and possibility of either using the arrangement of FIG. 1 for additional smoothening or only using the arrangement of rolls shown in FIG. 1 and not the pressure means without any supplemental smoothening in the smaller gap 15. The piston P can have a spring around the rod (not shown) or a valve-controlled inlet can be added to communicate with the chamber around the rod R below the piston P so that selective actuation of the piston P and cylinder C can occur for movement of the rolls 12, 14, 16 closer together or farther away from each other as illustrated by FIGS. 1 and 3 respectively. A suitable frame F can be provided for mounting and journalling the rolls as well as the piston and cylinder pressure means.

Also shown in FIG. 1 are cool air ducts 22 and 23 which are provided to maintain a working temperature of the backup rolls 14 and 16 less than that which may

permit alteration of the paper surface. Preferably, the operating conditions of all of the rolls should be maintained at less than 100° F.

Also additional cooling means for the satinizing rolls 12, 18 are provided. An inlet 30 permits circulation of a cooling fluid in the roll 18. Withdrawal of the fluid in the roll 18 through line 32 in a conventional manner permits recirculation to maintain the desired temperature.

In case of bilateral dulling according to FIG. 1 the paper web 10 first reaches the gap between rolls 12 and 14, is thereby embossed dull and then, via both reversing rolls 19, 21 and after moving around the lower metal roll 18 it is dulled in the gap between rolls 16 and 18 by the embossing roll 18 on the reverse side, then moves around the roll 16 and leaves the calender via the gap between both elastic rolls. The dulling embossed on it is thereby not eliminated by the two elastic rolls, but is merely blunted slightly and stabilized. It has been discovered, however, that the dulling of the top side of the paper web is blunted slightly more, as it is pressed during the passage twice by the elastic roll, while the bottom side is pressed once, in the gap between rolls 18 and 16.

Further according to the present disclosure, this disadvantage is obviated in that the metal roller has a slightly greater dulling than the metal roller 18.

In contrast to prior art, where dulling of the metal rollers was accomplished by sanding or etching, an even finer structure is needed now which is produced by different degrees of dull chrome plating.

The peculiarity of the plastic rolls makes it possible to apply higher line pressures of about 300 kg./cm. and to achieve thus besides dulling also a high smoothness. Because considerable amounts of heat are generated during the passage through the calender due to the deformation of the paper, particularly by the deformation work of the plastic rolls, while elevated temperatures can modify the sizing substance chemically, it is proposed, further according to the invention, to so cool all rolls that a maximum operating temperature of about 35° C. is not exceeded. The cooling is accomplished in the steel rolls from the interior by a coolant circulating in the roller perforation, while in the plastic rolls it is accomplished by blowing on cooling air which is expelled uniformly from nozzle bodies 22, 23 and aspirated away if necessary by suction openings located between the nozzles.

A particular advantage of the invention consists in that without modification of the chemical sizing recipe the same paper can be dulled optionally or be refined to high luster on a standard satinizing calender.

Naturally, it is within the scope of the invention to form the calender in a single-purpose design only for unilateral dulling merely from rolls 12 and 14.

In summary, there is provided a calender for satinizing fibrous webs with only two roller pairs arranged in a plane above each other in vertical alignment. The foregoing includes a first metallic satinizing roll, having a relatively hard rough surface; there is provided a first backup roll in first nip defining relationship with only said first metallic satinizing roll, having a resilient smooth surface comprising a synthetic material formed by polymerization of one or more materials. There is provided a second metallic satinizing roll, having a relatively hard rough surface; provided therewith is a second backup roll in second nip defining relationship with only said second metallic satinizing roll, having a resilient smooth surface comprising a synthetic material formed by polymerization of one or more materials. The foregoing also comprises fibrous web support means for continued feeding of said web first through said first nip in one direction of entry and thereafter through said second nip in substantially the same direction of entry, said first and second metallic satinizing rollers having uppermost and lowermost locations remote from each other; the first and second backup rollers directly adjoining each other in

location intermediate said first and second metallic satinizing rolls with looping angle amounting to 180° around one backup roll resulting in web exit in direction substantially opposite to direction of entry.

The foregoing features provide a decisive difference of making it possible to get along with an essentially smaller number of rollers without hereby in any way involving the goal or object in a less effective manner. In spite of the essentially smaller number of rollers, there is attained the object to roughen or emboss both sides of the paper surface. With the roller paper consisting of one metallic roughening or embossing roller and one roller covered with synthetic material, the roller covered with synthetic material is less stiff in and of itself and thus can encounter greater than the metallic roughening or embossing roller.

Further a roughening or embossing roller never works directly together with a roller covered with synthetic material covering without positioning therebetween a paper track so that the dust-type wear or rubbing off of the synthetic material roller does not become securely deposited only in the roughening or embossing depressions respectively elevations of the roughening or embossing roller, but rather also no powder or dust quantity becomes generated which deposits itself upon the machine parts and which would form residue or deposits upon the paper track. Otherwise, there results a "wash-out" or blurred roughening or embossing, prematurely strong wear of synthetic material covering and dust or powder crusts upon the calender or glazing rollers.

There arises neither a bending through nor drooping of rollers covered with synthetic material nor does there arise any direct operation of a roller covered with synthetic material with respect to the upper surface of a roughening or embossing roller.

For solution of the goal to carry out the roughening or embossing upon both outer surfaces of the paper track, there are different features utilized which are subject to limitation or restriction to the sample embodiment according to FIG. 1 of the patent drawings. These different features include the following:

(1) There are only two roller pairs arranged in a plane above each other and consisting respectively of a metallic roughening or embossing roller and a roller with a synthetic material covering whereby the product track or path is carried out respectively between only one roughening or embossing roller and only one roller having a synthetic material covering.

(2) Both roughening or embossing rollers form the upper and lower roller means.

(3) The paper track is introduced at a time in the same direction into the roller gap between the roughening or embossing roller and the roller with synthetic material covering.

(4) The angle of grip or looping angle of the one roller covered with synthetic material amounts to 180°.

Rollers with covering of synthetic material subject to intermediate positioning of the paper track engage against each other respectively. As indicated by FIG. 1 of the drawings, the product track or paper is introduced from the right toward the left between the rollers 14 and 12 and thereafter the same comes again between the rollers 16 and 18 in the same direction, respectively after looping or winding around the rolls 19, 21.

The product track or paper also can travel in opposite running direction. The same can next be introduced into the gap between the rollers 14 and 16 in order then to come into the roller gap between the rollers 16 and 18 of the roller gap between the rollers 14 and 12. Also in this case the running direction of the product track or paper between the embossing or roughening rollers and the pertaining roller means covered with synthetic material again is the same. The previously described track guidance with rollers 14 and 16 engaging against each other has the advantage that subsequently unembossed or

unroughened product track is guided between the rollers 14 and 16 and hereby no roughening or embossing is made smooth. (Compare opposite running direction of the product track according to FIG. 1.)

Both embossing or satinizing rollers are to have different embossing or satinizing depth. There is neither different roller diameter nor embossing or satinizing rollers to begin with but rather there is provided a different embossing or satinizing depth per se without any difference in pressure.

Substance of the elastic synthetic material rollers rests upon Polyamide as a basis. For instance, an elastic material such as Nylon would be among substances suitable for use in this location.

The foregoing in summary concerns a calender for mat or dull satinizing of paper paths consisting of two steel rollers located outwardly and vertically one above the other with dull or mat ridges and two elastic rollers arranged therebetween. This calender is characterized by way of unification of the following features in combination with each other:

- (A) The elastic rollers 14 and 16 consist of synthetic material;
- (B) The upwardly located steel roller 12 has a more coarse mat ridge means than the steel roller 18 located below;
- (C) The paper path or web 10 after passage and guidance between the one metal roller 12 and the elastic roller 14 arranged therewith caused to be guided around the second metal roller 18 and around the second elastic roller 16.

One of the features of the present invention is that high nip pressures in excess of 300 kg./cm. may be achieved, thereby not only providing a dulled finish but a high smoothness and uniform caliper.

It is, of course, to be understood that the present invention, is, by no means, limited to the particular construction shown in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A calender for satinizing fibrous webs directly with only two roller pairs arranged in a plane above each other in vertical alignment, comprising:

a first metallic satinizing roll, having a relatively hard rough surface for satinizing;

a first backup roll in first nip defining relationship with only said first metallic satinizing roll, having a resilient smooth surface comprising a synthetic material formed by polymerization of one or more materials;

a second metallic satinizing roll; having a relatively hard rough surface for satinizing;

a second backup roll in second nip defining relationship with only said second metallic satinizing roll, having a resilient smooth surface comprising a synthetic material formed by polymerization of one or more materials, and

fibrous web support means for continued feeding of said web first through said first nip in one direction of entry and thereafter through said second nip in substantially the same direction of entry, said first and second metallic satinizing rollers having uppermost and lowermost locations remote from each other and said first and second backup rollers directly adjoining each other in location intermediate said first and second metallic satinizing rolls with looping angle amounting to 180° around one backup roll resulting in web exit in direction substantially opposite to direction of entry and alternately for continued feeding of said web in just the opposite way.

2. The apparatus of claim 1 wherein said first and second backup rolls are further positioned to define a third nip therebetween, and said web passes through said third nip after passage of said web through said second nip.

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3. The apparatus of claim 2 wherein pressure means are provided to exert a force to increase pressure between the first and second backup rolls thereby to add smoothing effect upon the web passing in engagement between said backup rolls.

4. The apparatus of claim 1 wherein cooling means are provided to lower the operating temperature of each of said metallic satinizing rolls to less than 100° F.

5. The apparatus of claim 4 wherein with said vertically aligned rolls said nip pressure at each nip is in excess of 300 kg./cm., made possible by the weight of the metallic satinizing rolls and the cooling means.

6. The apparatus of claim 1 wherein cooling means are provided to lower the operating temperature of each of said backup rolls respectively to less than 100° F.

7. The apparatus of claim 1 wherein said satinizing rolls having a metallic surface having a fine dull embossing depth finish.

8. The apparatus of claim 1 wherein said backup rolls having a resilient smooth surface formed from a plastic.

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9. The apparatus of claim 1 wherein satinizing depth differs because said first satinizing roll has a slightly more rough surface than said second satinizing roll.

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U.S. Cl. X.R.

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