July 7, 1970 E. R. ERB 3,519,460

WEB PRINTING AND COATING METHOD AND APPARATUS

Original Filed April 4, 1963

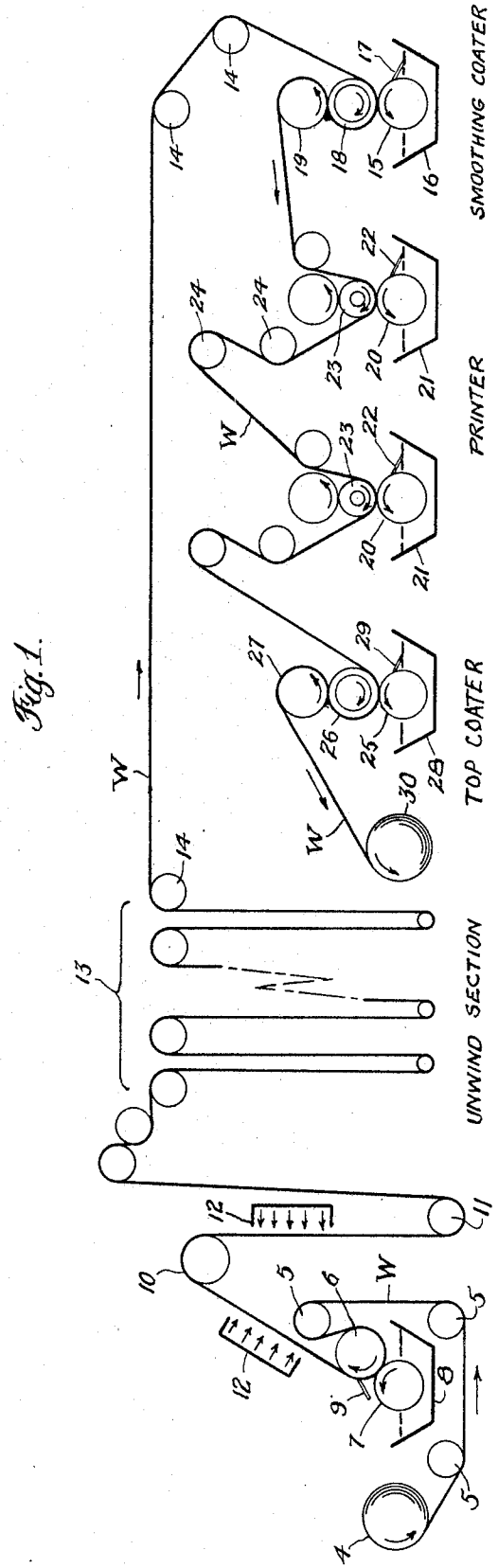


Fig. 1.

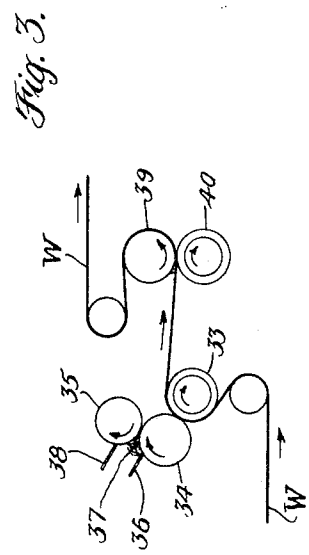


Fig. 3.

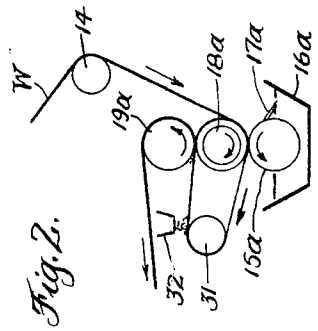


Fig. 2.

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United States Patent Office 3,519,460
Patented July 7, 1970

3,519,460

WEB PRINTING AND COATING METHOD AND APPARATUS

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Continuation of application Ser. No. 270,591, Apr. 4, 1963. This application Mar. 8, 1967, Ser. No. 633,647
Int. Cl. B41m 1/38; B05c 1/12
U.S. Cl. 117—15 21 Claims

ABSTRACT OF THE DISCLOSURE

Method and apparatus for use in coating a web in the manufacture of surface type covering material, especially fibrous webs employed in the manufacture of floor covering material. According to the method and apparatus the web is coated with a heat hardenable liquid polyvinyl resin organosol and is then passed into the nip of a rubber roll and a heated metal roll to develop a bead of liquid resin material in the nip from which coating material in liquid form is distributed on the surface of the web as it enters the nip, the coated side of the web being maintained in contact with the heated roll beyond the nip to harden the coating material.

This application is a continuation of my copending application Ser. No. 270,591 filed Apr. 4, 1963, now abandoned.

This invention relates to web coating and is particularly concerned with method and apparatus for continuously applying a coating to moving webs of the types commonly used in the manufacture of hard surface floor coverings, for instance fibrous webs such as paper or felt, especially asbestos felt.

Although not limited thereto, the invention is of especial advantage and utility in the application of a background or undercoating on which printed decoration is to be applied, and it is an important object of the invention to provide for the application of such a background or undercoating having greatly improved smoothness, even when applied to the relatively irregular surface of felted material, so that fine pattern designs may be applied, for instance for gravure type of printing equipment.

It has been known to apply a background or undercoating to a web which is subsequently to be printed with a decorative pattern, by a coating operation in which a film of a coating material is applied to the web by knife or roll coaters, and the web is thereafter subjected to heat for the purpose of drying the coating applied, for instance by passing the web through a heated oven. Also it is known that some previously applied and hardened coatings may be smoothed by feeding the web to the smooth surface of a planishing or similar smooth roll. Such an operation, however, requires considerable pressure and in consequence, with certain types of webs having considerable resilience, especially felted webs, after the planishing or smoothing operation, localized areas or groups of fibers of the web tend to spring back more or less to their original thickness or condition after the pressure is released. This leaves undesirable roughness or irregularity at the surface.

The present invention provides an improved coating technique adapted to apply a coating of unusual smoothness and uniformity as compared with prior techniques, the technique of the present invention being especially useful in providing a surface on which decorations may be printed with great accuracy and delicacy of detail.

Briefly, a typical operation according to the preferred practice of the present invention includes the feed of the web, for instance an asbestos web, into the nip between

an engraved applicator roll and a cooperating rubber covered or surfaced roll. The applicator roll dips into a reservoir of a liquid heat hardenable coating material and a doctor blade removes the excess, the remaining coating material being transferred from the engraved surface of the applicator roll to the web which is maintained in contact with the applicator roll by the rubber surfaced backup roll. The coated web is then fed partway around the rubber surfaced roll and into the nip between the rubber roll and a smooth surfaced and heated roll, the feed of the web being continued throughout a substantial part of the circumference of the heated roll and then delivered therefrom to other equipment. In this operation and with the equipment as just briefly described, the quantity and viscosity of the coating material applied to the web are selected so that a bead of liquid or semi-liquid coating material is maintained at the entrance side of the nip between the rubber roll and the smooth heated roll. This bead of material is, in effect, a reservoir of coating material in the process of hardening, and the material is delivered immediately from the bead or reservoir to the nip between the heated roll and the rubber roll, thereby constantly acting to fill cavities or depressions in the surface of the web at the point where the web commences its travel with the smooth surface of the heated roll. As the web advances in contact with the smooth heated roll the hardening or curing of the coating material is advanced sufficiently to retain the smooth surface characteristic of the heated roll.

In the foregoing operation, the action of the heated roll on the reservoir or bead of material at the entrance side of the nip between the heated roll and the rubber surfaced roll acts to stabilize the quantity of material present in the bead and to prevent build up of that quantity. This stabilizing action is apparently due to the fact that as the quantity of material in the bead tends to increase, the resultant increased surface area contact of the material in the bead with the heated roll tends to advance the stage of curing or hardening of the resin in the bead; and the material at a more advanced stage of hardening tends to be fed through the nip more rapidly, thereby counteracting the tendency for the quantity of material in the bead to build up.

Although the factors above mentioned are apparently involved, it is to be understood that other factors may influence the automatic stabilization of the quantity of material present in the bead; and in any event the effect of the system is to provide an automatically regulating action and the production of an exceptionally smooth surface on the coating applied.

The operation as described above does not require heavy pressures such as employed in certain prior types of coating and smoothing operations above mentioned, and in consequence the extent of and the effect of compression of localized areas of the web, with the subsequent "spring back" is greatly diminished. The action is much more in the nature of an operation which fills in the low areas on the web and thereby provides a coating having an unusually smooth surface.

How the foregoing and other objects and advantages are attained will appear more fully from the following description referring to the accompanying drawing which illustrates diagrammatically preferred forms of equipment employed according to the technique of the present invention. In the drawing:

FIG. 1 is a schematic view of a web handling, coating and printing equipment according to the present invention;

FIG. 2 is a diagrammatic view of a modified form of coating apparatus which may be included either in the system illustrated in FIG. 1, or in other systems as will appear; and

FIG. 3 is a further modified form of coating equipment according to the invention.

In considering the following description referring to the drawing, it is first noted that the description is given with reference to the coating of an asbestos felt web for use in a hard surface floor covering. Various features of the invention are of broader applicability and may be employed with other types of felt webs and also with other types of fibrous webs, for instance paper, although the invention is of especial advantage and utility in connection with the coating of fibrous webs of some appreciable resilience. In the following description reference is first made to the nature of the operations in general and thereafter specific reference will be made to the nature of the coating materials applied and other factors to be kept in mind in practicing the invention.

In the illustrative diagrammatic showing of FIG. 1, an asbestos felt web W is supplied from the supply reel **4** and passes around guide rolls **5** and thence around the backup roll **6** which retains the web in close proximity to the applicator roll **7** transferring coating material from the reservoir **8** to the web. A doctor blade **9** cooperates with the web on the backup roll **6** in order to remove excess coating material and return it to the reservoir **8**. From the roll **6** the web passes upwardly and then over a guide roll **10** and again downwardly to another guide roll **11**, the runs of the web between the rolls **6** and **10** and **11** being subjected to heat, for instance by hot air blowers or by radiant or gas type heaters, such as indicated diagrammatically at **12—12**, in order to dry or harden the coating material applied in this portion of the equipment.

The web is next fed to an unwind festoon mechanism bracketed at **13**, providing for storage of a considerable length of web between the initial coating stage described above and the subsequent stages which are described below.

From the festoon storage unit the web is fed over suitable guide rolls **14** to a "smoothing coater" of the type contemplated according to the present invention. In this coater an applicator roll **15** preferably having an engraved surface picks up coating material from the reservoir **16** and, after cooperating with the doctor blade **17**, transfers the coating material to the web in the nip between the applicator roll and the rubber covered backup roll **18**. The web carrying the coating material passes around the rubber covered roll and into the nip between the backup roll **18** and a smooth surfaced and heated metal roll **19**. The roll **19** cooperates with the rubber covered roll **18** to establish a bead or small reservoir of coating material at the entrance side of the nip in order to fill in low spots and apply a smooth coating which is subsequently partially hardened or cured by passage of the web around a portion of the circumference of the heated roll **19**.

From this coater, the web is delivered to the printing mechanism. This may include a number of stages of printing, two being shown by way of illustration in the schematic diagram, each of the two printing stages including an engraved roll **20** of gravure type, picking up ink from reservoir **21** and, after cooperation with the doctor blade **22**, transferring the design being printed to the web against the rubber surfaced backup roll **23**. Suitable guide rollers such as shown at **24** are provided in association with the various stages of printing. Ultimately the web leaves the printer section and may at this point be wound up on a mandrel or core for subsequent delivery to another coating apparatus for the purpose of applying a transparent wear layer on top of the printed decoration. However, the present invention contemplates direct delivery of the printed web to a coater of the general type represented by rolls **15**, **18** and **19**. As shown in FIG. 1 the applicator roll for this final coating is here identified by numeral **25**, the rubber covered backup roll being indicated at **26** and the heated roll at **27**. The applicator roll **25** picks up coating material from the reservoir **28** and transfers it to the web after cooperation with the doctor blade **29**. After passage through this coater, the web is delivered to a wind-up mandrel **30** in order to roll up the prepared material.

In a typical operation carried out in equipment of the kind described just above, the coating initially applied by the roll **7** may be in the nature of a sizing or primer coating for instance an aqueous dispersion of an elastomeric rubber or resin material preferably including some inert powdered filler material such as ground limestone.

The coating material applied by the applicator roll **15** in accordance with the technique of the present invention may comprise pigmented background material. For instance this coating may comprise a heat hardenable pigmented liquid vinyl organosol made up of ingredients as follows:

	Parts by weight
Polyvinyl chloride dispersion resin	200
Butyl benzyl phthalate (plasticizer)	100
Epoxidized soya bean oil (plasticizer and stabilizer)	12
Barium cadmium zinc stabilizer	9
Titanium dioxide (pigment)	62
Mineral spirits (diluent)	12

It will be understood that variations in the above formulation may be resorted to, although preferably the amount of plasticizer should be from about 30 to about 75 parts on the basis of 100 parts of resin, and the amount of pigment may be anything up to about 100 parts on the basis of 100 parts of resin.

The quantity of the coating material transferred to the web by the applicator roll **15** will depend chiefly upon the nature of the roll itself, especially the character of the engraving provided thereon. The type of engraving employed is not of particular importance, but is preferably substantially uniformly distributed over the surface of the roll in order to effectively distribute the coating material through the width of the web. Quadrangular, pyramidal or ruled engraved applicator rolls, commonly available, may be used. When the transferred portions of the coating material reach the nip between the rubber roll **18** and the smooth roll **19**, the coating material is spread completely uniformly throughout the entire surface of the web, as is intended, and in view of this the specific pattern or nature of the engraving on the applicator roll **15** is not of importance. The only factor here of significance is the total quantity of material transferred to the web, and that quantity should be sufficient to establish the bead or local reservoir of coating material in the entrance side of the nip between the rubber roll **18** and the smooth roll **19**. In addition to the matter of quantity, the viscosity of the coating material also influences the establishment of the bead or reservoir of material at the entrance side of the nip between the rolls **18** and **19**. The viscosity should preferably be of the order of 800 to 8000 centipoises as measured by the Brookfield Viscosimeter. Coating material of the kind given above by way of example has a viscosity of the order of 5000 centipoises.

Certain other factors also have some influence on the bead of the material formed in the nip on the rolls **18** and **19**, such as the nip pressure, the hardness or resilience of the rubber covered roll, the roll diameters, the temperature of the heated roll **19** and the speed of operation. Considerable leeway is permissible in various of these factors, but in a typical operation, the nip pressure would be of the order of 40 pounds per lineal inch. In such a typical operation, the rubber covered roll would be of hardness indicated by 70 on the Shore A scale, the roll diameter would be 12 inches for all three of the rolls (**15**, **18** and **19**), the temperature of the heated roll would be about 330° F., and the speed of the web 60 feet per minute. Conditions of operations such as those

referred to above will provide a coating having an average thickness of the order of .003 inch.

With regard to the operation of the smoothing coater described above it may further be mentioned that the bead or reservoir of material at the entrance side of the nip between rolls **18** and **19** though small, is ordinarily readily visible and sometimes may develop to a thickness even of the order of ⅛ to ¼ inch, but under most conditions the bead though visible is quite small and on occasion might be difficult to observe. However, if the feed of material is insufficient to develop some bead or reservoir, irregularities in the surface of the coating result. Conversely, an excessively large bead results in a rough coating because of irregular premature hardening.

A coating applied in the manner just described is hardened to the extent that printing thereon may readily be effected without difficulty, for instance printing of the gravure type. Because of the special smoothness of the coating thus provided, even on the relatively irregular surface of asbestos felting, very fine and intricate patterns may be printed with accuracy and uniformity. It will be understood that in the printer section, some drying will be applied to the web following each printing stage.

Although the invention contemplates obtaining a smooth surface for printing, it is mentioned that if desired the roll **19** of the smoothing coater may be provided with certain surface configurations, for instance projections in a pattern adapted to produce indentations in the coating being applied in the pattern of mortar joints between tiles. The areas between such joint simulating marks would of course be smooth and well adapted to receive printing.

The coating applied by applicator roll **25** may advantageously comprise a coating similar to that described above for use with the applicator roll **15**, except for the omission of the pigment. In this way a transparent coating may be applied over the printing in order to develop a wear layer on the product. Although some appreciable hardening of the transparent wear coating is provided by the action of the heated roll **27**, preferably the product would be subjected to further heating, for instance in an oven, which may be introduced either between the heated roll **27** and the windup reel **30**, or which may be subsequently applied by feeding the material wound up at **30** to and through a curing oven.

With regard to the roll **27**, which serves to contribute the desired surface characteristic to the coating applied and also to harden that coating, it may be mentioned that in the case of the transparent wear layer to be applied by the roll **25**, the roll **27** may either be smooth, or if desired be engraved or figured, instead of smooth surfaced. The action of this roll (**27**) is to contribute the desired surface finish, whether smooth or having surface configurations, at the time of setting or hardening of the coating material, thereby improving both accuracy and permanence of the desired finish surface on the coating material.

In connection with the coater comprising rolls **15**, **18** and **19** as shown in FIG. 1, it is pointed out that rolls **15** and **18** are preferably not driven, although roll **19** is driven. This provides for appropriate tensioning of the web through this coater mechanism, the rolls **15** and **18** merely being rotated by virtue of engagement with the web. Similarly the same type of action is provided in the other coater by driving roll **27** and permitting the rolls **25** and **26** to be rotated by virtue of contact with the web.

The rubber covered roll **18** between rolls **15** and **19**, and also the rubber covered roll **26** between rolls **25** and **27**, is preferably of axial dimension slightly less than the width of the web, although the rolls **15** and **19** are desirably at least as long as the web. In this way transfer of coating material on the surface of the rubber roll from the applicator roll **15** or **25** to the heated roll **19** or **27** is avoided. This is of importance especially with thin fibrous webs such as paper, in order to preclude the build up of resinous coating deposits toward the ends of the heated roll. The heated roll is also desirably somewhat longer than the width of the web in order to be sure to provide for heating and thus hardening of resin throughout the entire width of the web, thereby avoiding transfer of unhardened resin to equipment through which the web is subsequently passed.

As above indicated, the overall system for coating and printing the asbestos web for purposes of preparing a floor covering, need not necessarily include the coater comprising rolls **25**, **26** and **27**, in which event a transparent top coating may be applied over the printing in some other manner.

It is further to be noted that the application of a primer coat by means of the applicator roll **7** illustrated in FIG. 1 is not essential to the broader aspects of the present invention. This primer coat may be omitted, in which event it may be preferred to apply a thicker coating by means of the coater comprising rolls **15**, **18** and **19** than that used when a primer coating is also employed. However, either with or without the primer coating, the background coat is desirably of thickness of the order of .002 inch to .005 inch. In instances where the primer coat is used, the material applied as the primer coat, although much of it may penetrate into the fibrous material of the web, may represent coating material equal to a thickness of about .0003 to .0005 inch.

Turning now to the modification illustrated in FIG. 2 it will be noted that the rolls there shown are similar to the rolls **15**, **17** and **19** in FIG. 1. In FIG. 2, these rolls are identified by numerals **15***a*, **18***a* and **19***a*. Roll **15***a* picks up coating material from the reservoir **16***a* and after passing the doctor blade **17***a* the surface of the roll **15***a* transfers coating material to the web W in the nip between the applicator roll **15***a* and the rubber backup roll **18***a*. In the embodiment of FIG. 2, instead of passing the web around the surface of the rubber surfaced roll **15***a* directly into the nip between rolls **18***a* and **19***a*, the web is led to one side of the rolls and over still another roll **31**, and thence back to the nip between rolls **18***a* and **19***a*. While in its path to one side of the rolls **18***a* and **19***a*, decorative particulate material, for instance aluminum flakes or solid chips or droplets of colored liquid vinyl organosol or plastisols or of other materials, are applied to the coated and still wet surface of the web, for instance by means of a trough type distributor indicated in outline at **32**. By this arrangement decorative particles which contribute to the overall pattern effect may be added at this step of the operation even prior to the printing steps, and these decorative particles will be securely bound in the coating material applied especially because of the action of the nip between rolls **18***a* and **19***a* and the subsequent heating of roll **19***a*.

Turning now to the modification illustrated in FIG. 3, it is first pointed out that this arrangement is contemplated for use as an alternative to the coater comprising rolls **15**, **18** and **19** or the coater comprising rolls **25**, **26** and **27**, or the coter comprising rolls **15***a*, **18***a* and **19***a*. The primary difference between the arrangement of FIG. 3 and the arrangement of any one of the other coaters mentioned lies in a separation of the equipment into two parts, one part serving for application of the coating, and the other part for the distributing, smoothing, and hardening of the coating material. Thus in FIG. 3 the web is initially led into a nip between a rubber covered backup roll **33** and a casting roll **34** of a "reverse" roll coater, which also includes a metering roll **35**. A dam **36** cooperating with roll **34** aids in defining a reservoir of coating material indicated at **37** which is carried by the roll **34** past the surface of roll **35** to the web at the backup roll **33**. A blade **38** serves to return excess coating material from the roll **35** to the reservoir **37**.

In this arrangement the direction of rotation of the rolls is indicated and the spacing of rolls **34** and **35** regulates the amount of coating material applied to the web. The rubber covered backup roll **33** is preferably of

slightly shorter length than the width of the web. The coated web is fed from the roll **33** into the nip between a heated roll **39** and a rubber backup roll **40** and these rolls serve to perform the functions described above in connection with the cooperation of roll **18** with roll **19** (or the corresponding rolls **26–27** and **18***a*–**19***a*).

Here again a bead or reservoir of material is developed at the entrance side of the nip of the rolls **39** and **40** and this bead is automatically prevented from undue enlargement by the action already described above, so that it stabilizes and provides for the desired uniformly smooth application of coating material. For reasons already noted above, the rubber roll **40** is preferably slightly shorter than the width of the web.

In the arrangement of FIG. 3 all three of the reverse roll coater rolls **33**, **34** and **35** are driven although roll **40** is advantageously freely rotative under the influence of the web itself as driven by the drive roll **39**.

When the system of FIG. 3 is being used to provide a smooth background coating for quality printing, roll **39** is desirably a smooth surfaced metal roll which is heated as already brought out in order to harden the coating being applied. In the event of use of the arrangement of FIG. 3 for applying a transparent top coating, the roll **39** may either be smooth or may be engraved or otherwise provided with surface configurations, for purposes already brought out.

I claim:

1. In the manufacture of a floor covering, the steps of applying to the face side of a felt web a coating of a heat hardenable pigmented liquid polyvinyl resin organosol by feeding the web in contact with an applicator roll, feeding the web carrying said liquid coating into the nip between a rubber roll and a smooth heated roll with the coated side of the web presented toward the heated roll, the quantity and the viscosity of the organosol applied to the web being selected to maintain a bead of the coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, partially curing and hardening the applied liquid coating by feeding the web through said nip and beyond the nip with the coated side of the web in contact with the heated roll, thereafter printing a decorative pattern on the partially cured and hardened coating, applying a second coating of a transparent liquid heat hardenable polyvinyl chloride resin material to form a wear layer over the decorative pattern, and passing the coated web through an oven to further cure the first coating and to cure the second coating.

2. A method according to claim **1** in which the second coating is a heat hardenable transparent liquid polyvinyl resin organosol and in which the second coating is applied in the same manner as defined in claim **1** for the first coating.

3. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of a heat hardenable liquid polyvinyl resin organosol by feeding the web in contact with an applicator roll, feeding the web carrying said liquid coating into the nip between a rubber roll and a heated metal roll with the coated side of the web presented toward the heated roll, the quantity and the viscosity of the organosol applied to the web being selected to maintain a bead of the coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, partially curing and hardening the applied liquid coating by feeding the web through said nip and beyond the nip with the coated side of the web in contact with the heated roll, applying additional polyvinyl resin coating materials to the partially cured and hardened coating, and thereafter passing the coated web through an oven to further cure the first coating and to cure the additional resin coating materials.

4. A method according to claim **3** in which said rubber roll lies between the applicator roll and the heated roll and serves to maintain the web in contact both with the applicator roll and with the heated roll, the rubber roll being out of contact with the fibrous web in the edge regions thereof.

5. A method according to claim **3** in which a separate rubber roll is used to retain the web in contact with the applicator roll.

6. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of a heat hardenable liquid polyvinyl resin organosol by feeding the web through a first nip between a pair of rolls comprising an applicator roll and a backup roll, feeding the web carrying said liquid coating into a second nip between another pair of rolls comprising a rubber roll and a heated metal roll with the coated side of the web presented toward the heated roll, the quantity and the viscosity of the organosol applied to the web being selected to maintain a bead of the coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, and partially curing the applied liquid coating by feeding the web through said second nip and beyond the nip with the coated side of the web in contact with the heated roll, applying additional polyvinyl resin coating materials to the partially cured coating, and thereafter passing the coated web through an oven to further cure the first coating and to cure the additional resin coating materials.

7. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of a heat hardenable liquid polyvinyl resin organosol by feeding the web in contact with an applicator roll, applying to said coating a decorative particulate material, feeding the web carrying said liquid coating and the particulate material into the nip between a rubber roll and a metal roll heated to a temperature well above that of the coating on the web and with the coated side of the web presented toward the heated roll, the quantity and the viscosity of the organosol applied to the web being selected to maintain a bead of the coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, and hardening the liquid coating material by feeding the web through said nip and beyond the nip with the coated side of the web in contact with the heated roll.

8. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of heat hardenable liquid polyvinyl resin organosol, feeding the web carrying said liquid coating into the nip between a rubber roll and a heated roll with the coated side of the web presented toward said heated roll, the quantity and the viscosity of the organosol applied to the web being such as to maintain a bead of the coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, while the applied coating and said bead are still liquid, feeding the web through said nip and then advancing the coated web beyond the nip with the coated side of the web in contact with the heated roll to harden the coating applied thereto.

9. A method according to claim **8** in which the application of the organosol is effected by passing the web in contact with an applicator roll and in which said applicator roll is separated from said rubber and heated rolls.

10. A method according to claim **8** in which the coated web is fed into the nip between a rubber roll and a heated roll having surface configurations, to thereby provide for formation of a hardened coating on the web with complementary configurations in its surface.

11. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of a heat hardenable liquid polyvinyl resin organosol, feeding the web carrying said liquid coating into the nip between a pair of rolls comprising a rubber roll and a heated metal roll rotating in opposite

directions, with the coated side of the web in contact with the heated roll, the quantity and the viscosity of the organosol applied to the web being selected to maintain a bead of coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, while the applied coating is still liquid feeding the web into the nip, and then advancing the coated web beyond the nip with the coated side of the web in contact with the heated roll throughout a substantial part of the periphery of the heated roll to harden the coating on the web while it is in contact with the heated roll.

12. A method according to claim **11** in which the web coated with the liquid polyvinyl resin organosol is fed into the nip between a pair of rolls comprising a rubber roll and a heated metal roll, the metal roll having surface configurations to thereby provide for formation of a hardened coating on the web having lands and valleys complementary to the configurations on the roll.

13. A method according to claim **12** and further including the step of printing a decorative color pattern upon the lands of the hardened coating to thereby develop a contrast with the valleys.

14. In the manufacture of sheet type covering material, the steps of applying to the face side of a fibrous web a coating of a heat hardenable liquid polyvinyl resin organosol, feeding the web carrying said liquid coating into the nip between a pair of rolls rotating in opposite directions and comprising a rubber roll and a heated metal roll having a network of raised portions contacting the coated side of the web, the quantity and the visocsity of the organosol applied to the web being selected to maintain a bead of coating material in said nip acting as a reservoir of coating material to fill cavities or depressions in the face side of the web, while the applied coating and said bead are still liquid feeding the web into the nip, advancing the coated web beyond the nip with the coated side of the web in contact with the heated roll throughout a substantial part of the periphery of the heated roll to harden the coating on the web while it is in contact with the heated roll, thereby providing a contoured surface on the hardened coating with a network of valley areas complementary to the raised portions of the heated roll and simulating mortar joints between land areas, and applying color material to certain of said areas in order to develop a contrast between valley and land areas.

15. A method according to claim **14** and further including the step of applying a transparent heat hardenable liquid polyvinyl resin organosol coating over the color decorated coating on the web, and thereafter heating the coatings to fuse the resin materials thereof.

16. Apparatus for use in applying a coating to a fibrous web comprising a supply reservoir of liquid heat hardenable coating material, an engraved applicator roll running in said reservoir, a doctor blade cooperating with said engraved roll, a rubber roll above and bearing against the engraved roll and providing with the engraved roll a nip through which the web is passed, the rubber roll being shorter than the width of the web, a metal roll above and bearing against the rubber roll and providing with the rubber roll a nip through which the web is passed, means providing for engagement of the web being coated with a major part of the periphery of the metal roll, and means for heating the metal roll sufficiently to solidify the liquid coating on the web, the heated roll being positively driven and the applicator and rubber rolls being rotated by the web.

17. Apparatus according to claim **16** in which the heated roll has a smooth surface to impart a smooth finish to the coating being solidified on the web.

18. Apparatus according to claim **17** in which the heated roll has a configured surface to impart a complementarily configured surface to the coating being solidified on the web.

19. Apparatus for use in applying a coating to a fibrous web including a pair of rolls comprising a heated metal roll and a rubber backup roll cooperating to provide a nip through which the web is passed, means providing for feed of the web with one surface thereof in contact with a substantial portion of the periphery of the heated roll, and an applicator roll for applying a heat hardenable liquid vinyl resin material to said one surface before entrance of the web into said nip, the heated roll being power driven and the backup and applicator rolls being rotated by the web.

20. Apparatus for use in applying a coating to a fibrous web comprising a supply reservoir of liquid heat hardenable coating material, an engraved applicator roll running in said reservoir, a doctor blade cooperating with said engraved roll, a backing roll bearing against the engraved roll and providing with the engraved roll a nip through which the web is passed, a pair of rolls in addition to said backing and engraved rolls and being spaced therefrom to provide a web run therebetween, said pair of rolls comprising a rubber roll and a metal roll bearing against each other and providing a nip receiving the web carrying the liquid coating material, means providing for engagement of the web being coated with a major part of the periphery of the metal roll, and means for heating the metal roll sufficiently to solidify the liquid coating on the web.

21. Apparatus for use in applying a coating to a fibrous web comprising a supply reservoir of liquid heat hardenable coating material, an applicator roll for delivering coating material from the reservoir to the fibrous web, a pair of rolls in addition to said applicator roll and being spaced therefrom to provide a web run therebetween, said pair of rolls comprising a rubber roll and a metal roll bearing against each other and providing a nip receiving the web carrying the liquid coating material, means providing for engagement of the web being coated with a major part of the periphery of the metal roll, and means for heating the metal roll sufficiently to solidify the liquid coating on the web.

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U.S. Cl. X.R.

117—111, 76; 118—101, 119

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,519,460 Dated July 7, 1970

Inventor(s) EDWARD R. ERB

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 30, "17" should read --18--. Column 10, line 4, "17" should read --16--.

SIGNED AND
SEALED
NOV 10 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334