Aug. 5, 1941. S. H. BERCH ET AL 2,251,264

MEANS OF COATING MATERIAL

Filed Aug. 9, 1938 3 Sheets-Sheet 1

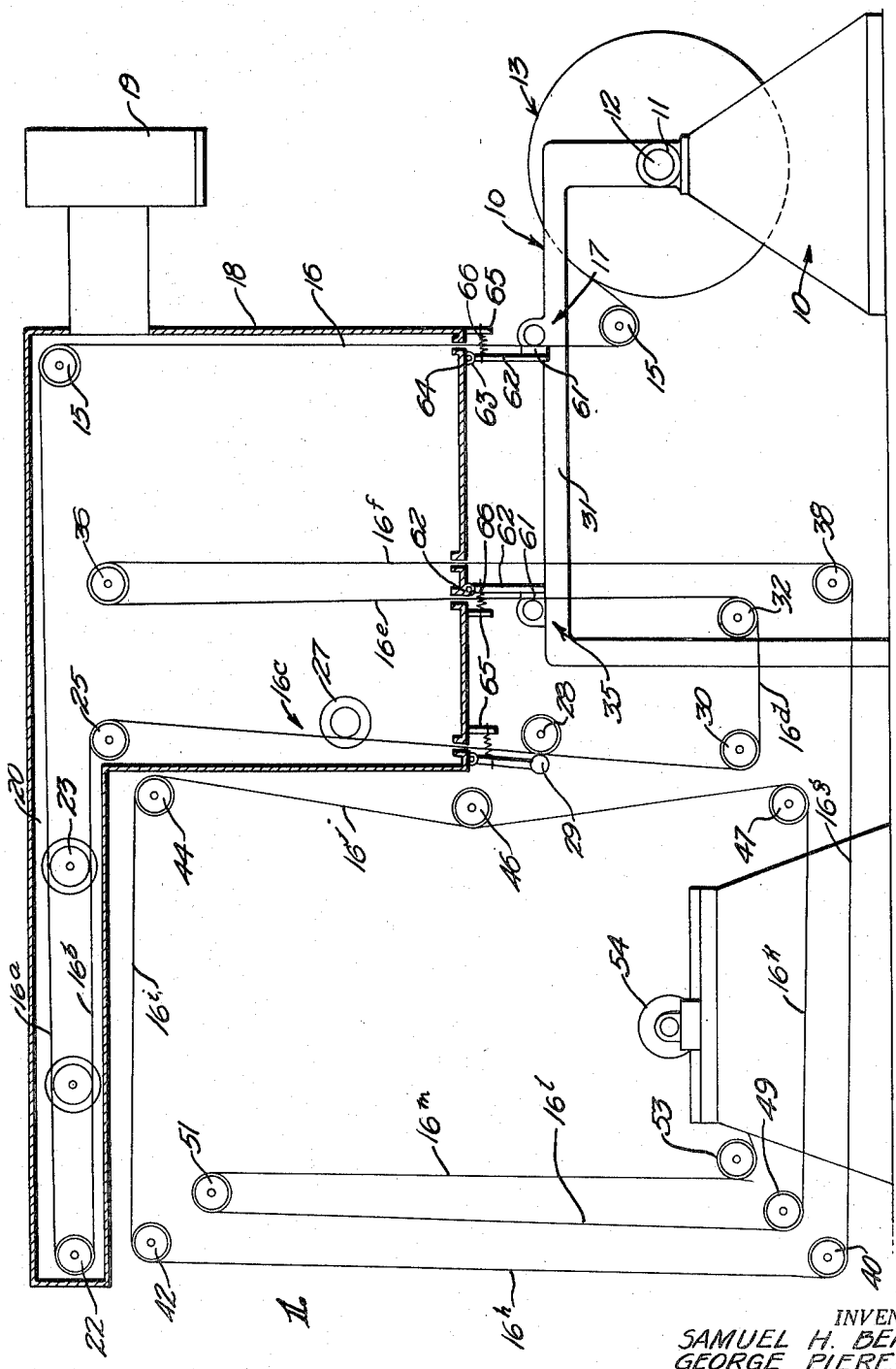


Fig. 1.

INVENTORS
SAMUEL H. BERCH
GEORGE PIERETTI
BY James M. Abbett
ATTORNEYS.

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Filed Aug. 9, 1938 3 Sheets-Sheet 2

Fig. 2.

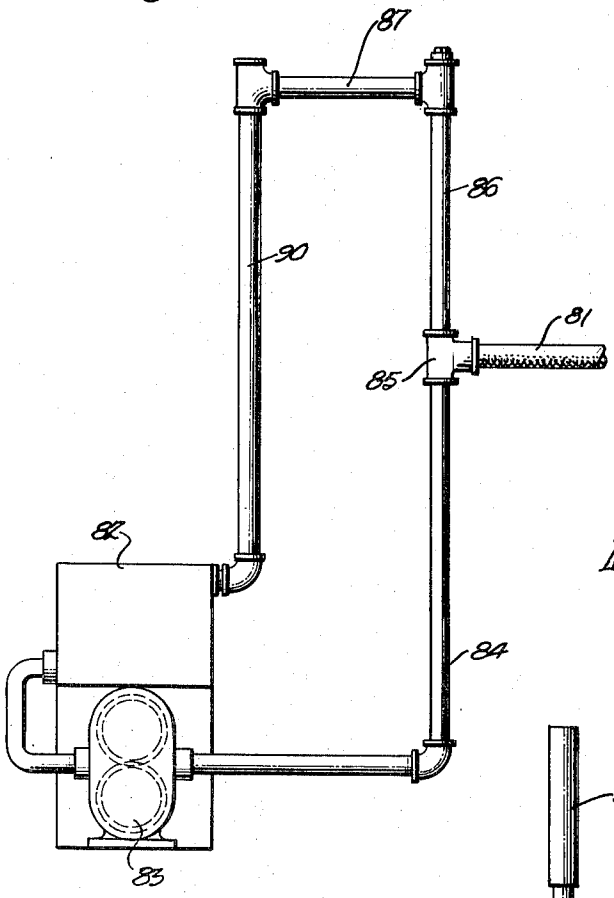
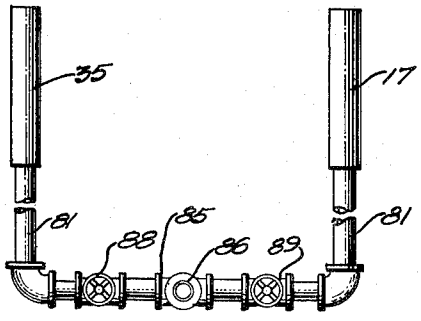


Fig. 6.



INVENTORS
SAMUEL H. BERCH
GEORGE PIERETTI
BY James M. Abbett
ATTORNEYS.

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Fig. 3.

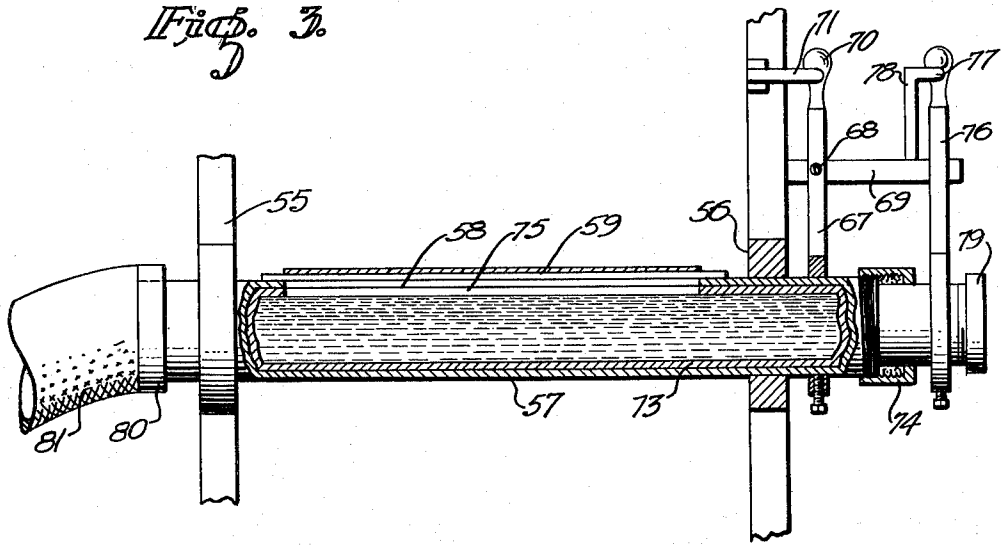


Fig. 4.

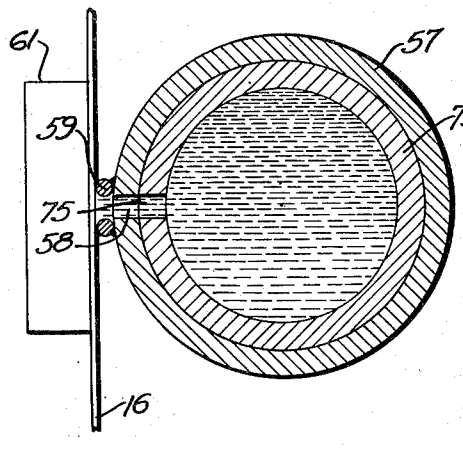
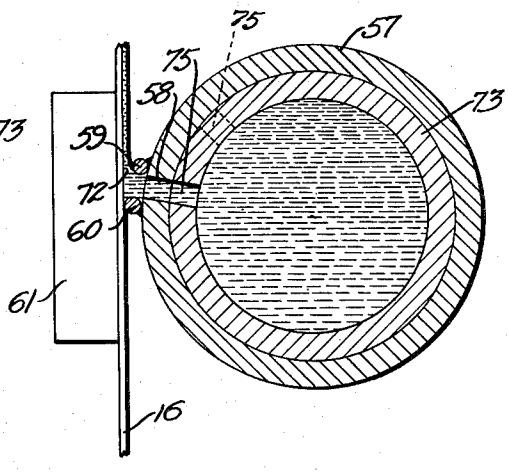


Fig. 5.



INVENTOR.
SAMUEL H. BERCH
GEORGE PIERETTI
BY James M. Ablett
ATTORNEYS.

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2,251,264

MEANS OF COATING MATERIAL

Samuel H. Berch, Beverly Hills, and George Pieretti, Los Angeles, Calif.

Application August 9, 1938, Serial No. 223,832

5 Claims. (Cl. 91—43)

This invention relates to the problems of applying a coating to a surface, and particularly pertains to a means of coating material.

In various industries it is desirable to apply a coating of paint, lacquer, water-proofing materials or compounds to the surface of a piece of material, and this is particularly true in the preparation of sheet stock used in making blanks for cartons, covers, labels, or the like. In such instances it is desirable to coat the surface of the material or to treat it uniformly with a liquid and in such a manner as to insure that the material may be rapidly handled and will quickly dry. In applying such materials to a surface to be coated it is evident that the coating material is of a quick drying character, and it will thus of necessity tend to quickly set when the air strikes it. One problem heretofore experienced in connection with the application of such coatings has been that the air strikes the material and causes it to begin to set before it has been completely and uniformly applied.

It is the principal object of the present invention, therefore, to provide a method and means of directly and uniformly applying a coating substance to sheet material rapidly and in a manner to insure that the air does not have access to the surface upon which the material is directly applied until the application has been complete and in a further manner to insure that the coating will be uniformly and rapidly applied to a desired thickness or in a desired quantity as the material passes through the apparatus.

The present invention contemplates the provision of means for carrying out the invention whereby sheets of material may be passed through a machine, during which time the material is uniformly spread over the surface of the material in a controlled flow and in intimate contact with the surface being treated or coated.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view in elevation showing a typical machine for carrying out the present invention.

Fig. 2 is a view in end elevation showing the apparatus adjacent to one of the applying fountains.

Fig. 3 is an enlarged view in horizontal section and elevation showing the details of construction of an applying fountain.

Fig. 4 is an enlarged view in transverse section through the fountain element disclosing it as being in a sealed position against a member upon which a coating is to be applied.

Fig. 5 is a fragmentary view showing the adjustment of the fountain unit showing the fountain element in a position to cause a flow of coating material onto a surface to be coated.

Fig. 6 is a view in side elevation as seen on the line 5—5 of Fig. 2 and shows the piping through which the coating material flows.

Referring more particularly to the drawings, 10 indicates the main frame of the structure. The structure as here shown in Fig. 1 is of large proportions and is designed to treat a continuous strip of sheet material which is fed through the apparatus, for example the overall length of the structure here disclosed is approximately forty feet and the overall height is approximately eighteen feet. This provides sufficient length so that the coating will properly set and dry on the sheet of material before it is used or wound upon a reel for subsequent use. It is to be understood, however, that while the invention as here described is concerned with a continuous length of strip material that various modifications might be made even to the extent of treating individual pieces of material by the method and essential means here shown without departing from the spirit of the invention.

The frame structure 10 carries a suitable bearing 11 for rotatably supporting a shaft 12 upon which a roll 13 of sheet material has been wound. This roll of material may have been previously printed to carry any indicia desired and is now in a condition to be treated. In the example of the invention here shown the strip of material in the roll 13 is a selected type of paper stock to be used in making a cover for the mouth and neck of a milk bottle, as disclosed in our issued U. S. Letters Design Patent No. D-103,266 issued on the 16th day of February, 1937.

In the use of this type of bottle cover it is desirable to coat both surfaces of the paper blank with a material which has a characteristic of rendering the paper water-proof and impervious to the effects of moisture, even though the cap is submerged in water for a considerable period. It is therefore necessary to provide means whereby the paper strip in the roll 13 may be coated on both sides and may be handled and rolled without impairing the quality of the coating applied thereto. In order to accomplish this result the strip of material forming the roll 13 is led from the roll 13 around a roller 15, and then is led vertically to an overhead roller 15'. This vertical portion is here indicated at 16 and it will be seen that in its vertical path of travel it passes through an initial coating station 17, which will be described in detail hereinafter.

Above the coating station is a hood 18 through which the portion 16 of the strip passes and within which its drying process begins. The hood 18 is fitted with a fan 19 which blows air from the hood and introduces it into a horizontally extending trough 20 with which the hood communicates. The trough 20 accommodates a horizontal length 16a of the strip which is led over a roller 22 in horizontal alignment with the roller

15'. An intermediate roller 23 is disposed between the rollers 15' and 22. This roller is flanged at opposite sides and guides a strip portion 24 between the flanges as the roller 23 is driven. An idler roller 25 is provided within the hood 18 and over this roller the strip portion 16b is led. A downwardly extending length 16c of the strip is led around a guide roller 27 as the strip passes between a feed roller 28 and a pressure roller 29. An idler roller 30 is mounted on the frame structure 10 below the horizontal frame portion 31. The central axes of the rollers 25 and 30 are in vertical alignment but the central axis of the roller 27 is offset therefrom to tend to take up the slack in the length 16c and also to guide the length of strip 16c between the end flanges of the roller 27.

Spaced from and in horizontal alignment with the idler 30 is an idler 16d. A length of strip 33 passes from the roller 30 to the roller 32, after which a vertical length of strip 16e is led upwardly and through a second fountain station 35. The fountain stations 17 and 35 are mounted upon the portion 31 of the frame. At the initial station 17 coating is applied to one side of the strip of material, and due to the manner of manipulating the strip as it passes around the various rollers coating is applied to the opposite side of the strip at the station 35.

The length 16e of the strip is then led over an upper idler 36 and a downward vertical length 16f travels through the hood 18. This length is led around a lower idler 38, after which a horizontal strip 16g passes around an idler 40. A vertical length 16h of the strip then is led upwardly and passes around an idler 42 where a horizontal length 16i passes around a driving drum 44. This driving drum 44 is of larger diameter than the idlers and thus has a surface speed in excess of the speed of rotation of the other rollers. As a result the drum 44 tends to take up the slack in the entire strip. A downwardly extending length 16j of the strip is then led down and around an offset flange to guide roller 46. It then is carried around a roller 47. A horizontal length 16k of the strip passes around a roller 49 and an upper extending length 16l of the strip leads to a roller 51, after which a length 16m leads around a guide roller 53 and onto the reel 54, where it is wound.

It is to be understood that while power is here indicated as being generally applied to the reel 54 and certain of the rollers, that the driving arrangement may be changed to suit conditions without departing from the spirit of the invention.

By reference to Fig. 1 it will thus be seen that the strip of material 16 unwound from the roll 13 and onto the reel 54 will pursue a sinuous path of travel of sufficient length to insure that any coating applied to it at the coating stations will be sufficiently dry to permit the strip 16 to be wound on the reel 54 without being tacky.

The present invention is particularly concerned with a method and means of continuously and uniformly applying a coating material to the sheet material in an efficient and otherwise desirable manner. This is accomplished by the fountain structures, one of which is indicated at 17 and another one at 35. The only difference between these two structures is that they operate upon opposite sides of the strip.

The frame portion 31 includes a pair of horizontal members upon which journal boxes 55 and 56 are mounted. These boxes rotatably support a distributing sleeve 57 which extends horizontally and transversely of the path of travel of vertically moving lengths of the strip 14. By way of example the initial fountain unit 17 will be described, it being understood that the construction will be identical with that of the fountain 35. The distributing sleeve, as shown in Fig. 4, is a tubular cylindrical member having a longitudinally extending slot 58 through its wall. At the opposite longitudinal edges of the slot bearing lips 59 and 60 are secured or formed. These lips are preferably circular and when in vertical alignment they uniformly contact the surface of the vertical length 16 of the strip of material. This strip of material is held in its properly aligned position by a yieldable back plate 61 which is mounted for horizontal swinging movement upon a lever arm 62 by a bearing 63. The lever arm 62 is mounted upon a pivot 64 and is fitted with a spring arm 65 which is engaged by a spring 66 tending to yieldably hold the plate 61 against the face of the strip portion 16 as the portion 16 passes upwardly between the back plate 61 and the distributing sleeve 57 of the fountain unit.

By reference to Fig. 3 of the drawings it will be seen that the longitudinal length of the slot 58 is less than the overall width of the strip portion 16. This insures that an untreated edge will occur along each margin of the strip. This feature is of particular importance since at the present time uncoated portions are required upon blanks so that edges may be glued together. This cannot be accomplished on coated surfaces and it therefore becomes necessary to cut off the coating by the use of a suitable solvent in order to provide adhesive receiving surfaces. This is expensive and unsatisfactory. By the selection of a longitudinal slot of a desired length it is possible to produce any desired width of coated surface and any desired marginal width of uncoated surface.

In applying coatings to sheet material it is necessary to apply the coating in a desired quantity or to a desired thickness. This is accurately controlled in the present instance by rotation and adjustment of the sleeve 57 in its bearings 55 and 56. The rotation and adjustment is brought about by a lever arm 67 which is fixed upon the sleeve 57 and extends radially therefrom. This arm carries an adjusting screw 68 which bears against a stop arm 69. The adjusted length of the screw 68 determines the degree of rotation of the sleeve 57. A finger 70 is formed at the end of the lever 67 and is engaged by a hook 71 which will temporarily hold the lever 67 in its lowermost position. Due to this arrangement the sleeve 57 may be set in a rotated position, as indicated in Fig. 5. Here it will be seen that the upper lip member 59 will be spaced from the surface of the strip portion 16 so that the liquid material may flow outwardly through a throat 72 and will be spread across the surface and drawn therewith as the strip 16 travels upwardly. It will be evident that when the sleeve 57 is rotated to the position shown in Fig. 4 of the drawings that no appreciable amount of coating material will be fed onto the strip 16, thus when the sleeve is in the position shown in Fig. 4 no coating action will take place. It will be seen, however, that under all circumstances the slot 58 will be liquid sealed so that the coating liquid within the sleeve will not dry or congeal due to contact with the air and for the further important reason that there will be no opportunity for any action of the air to take place upon the coating material as applied prior to the application of

the coating material to the strip 16. The coating material is directly and uniformly applied continuously and to a desired thickness. It may be necessary at times to interrupt the flow of coating liquid entirely, this is done by a positively acting tubular mandrel 73 which telescopes within the sleeve 57 and is held by a suitable stuffing box 74. This mandrel is formed with a longitudinal slot 75 which may be brought to register with the slot 58 in the sleeve or may be moved from register therewith and shifted to the dotted line position, as indicated in Fig. 5, at which time the slot 58 in the sleeve will be completely closed.

A lever 76 is secured on the outer extending end of the mandrel and is provided with a finger 77 which may be engaged by a hook 78 to hold the mandrel in its open position when desired. This end of the mandrel is closed with a plug 79. The opposite end of the mandrel is open and communicates with the interior of the sleeve 57. The end of the sleeve 57 adjacent to the open end of the mandrel is fitted with a coupling 80 to which a flexible conduit 81 is attached and through which the coating liquid may flow.

The supply of coating liquid is fed from the fountain units under a constant head gravity flow. This structure includes a tank 82 within which the coating liquid is stored. The tank is fitted at its lower end with a pump 83 which forces the liquid upwardly through a pipe 84. This pipe extends to a desired height and has a manifold 85 at its upper end. An upwardly extending pipe 86 is connected therewith, the upper end of this pipe carries cross pipe 87 connected by a pipe 90 leading to the tank 82. The manifold pipe is fitted with valves 88 and 89. At the outer ends of the manifold pipe are connected the separate conduits 81 for the fountain units 17 and 35. It is to be understood that the pump 83 is driven at a relatively slow speed which has direct relation to the requirements of the machine in coating materials. It has been found that to directly and positively apply the coating to the material at a constant rate of speed it is unsatisfactory. Variations in the porosity of the material to be coated and variations in the consistency of the coating material may make a considerable difference in the feed requirements. It also may happen that the fountain must be completely closed at times. This operation must be independent of the operation of the pump. Thus, the feed of the pump is maintained at a rate which will always elevate the coating material in the pipes 84 and 86 to a level above the T 85. Under normal conditions the flow of coating material from the fountain and the manifold connection 18 will be sufficient to prevent the pipes 84, 86, 87 and 90 from being completely filled. Thus it will be recognized that the pipe 86 will in effect be a stand pipe having a head of coating material therein so that the material may freely flow downwardly and outwardly from the pipe 86 and into the manifold connection 81. This is not, therefore, a positive pressure head but a continuous pressure head, which exerts a suitable force to feed the coating material to the fountain and to maintain the fountain adequately supplied with coating material as the coating material is carried away upon the surface of the sheet to be coated. The rate of feed, therefore, is dependent upon the consistency of the coating material and its cohesion with the surface to be coated. This is in no wise dependent upon the force exerted by the pump. When the quantity of material drawn off is in a lesser amount than that being delivered to the pump the surplus material will accumulate in the pipe 86 and may flow over into the return pipe 90 through the pipe 87. In the event that for any reason the flow of material from the fountain is completely interrupted the fluid will circulate continuously through the pump, the system of pipe shown in Fig. 2 of the drawings, and the tank 82. This obviates any necessity to interrupt the flow of the coating material through the circulating system and insures that it will flow freely through these pipes without the possibility of setting or becoming solidified as might be the case if the circulation was completely interrupted and the pipes and pump were filled with the material. Thus, the head of liquid will be maintained as it returns into the pipe 90 and a flow will take place through the manifold 85 under the substantially constant head of liquid pressure as established by the height of the cross pipe 87 above the lever of the manifold and the continuous pump pressure.

In operation of the present invention the tank 82 is filled with a coating liquid, such for example as a selected degree of lacquer. The strip of material 16 is threaded through the machine and around the rollers and onto the reel 54. The distributing sleeves 57 of the fountain units 17 and 35 are rotatably adjusted to produce a desired condition, as shown by example in Fig. 5, after which the mandrel 73 is rotated to bring its slot 75 into register with the slot 58 in the sleeve 57. The driving action is then produced on the various rollers and the reel so that the strip of material 16 will be drawn along its entire sinuous course of travel from the roll 13 to the reel 54. At the same time the pump 83 for the coating liquid will then be operated to force the liquid upwardly through pipe 84, thence through the pipe 85 to the stand pipe 86. The liquid will then be forced by action of the pump through the manifold 85 and the conduits 81 to the sleeves 57 under the constant head in pipe 86. The head of liquid maintained in the pipe 86 will therefore determine the pressure imposed upon the liquid in the fountain and will insure that as the liquid is being drawn out of the fountain as it adheres to the surface being coated the supply will be continuously replenished under the force of the head maintained in the pipe 86. It is further to be noted that since the nozzle portion of the fountain as shown in Fig. 5 is inclined so that contact is made between the member 60 and the surface of the sheet portion 16 below the point of contact of the coating material with the surface and the member 59 is spaced from the surface a layer of coating material of a desired thickness will be applied to the sheet of material and will be drawn upwardly without being scraped by the nozzle and at the same time assuring that the thickness of the layer of coating material will be uniform, and that any surplus material which might be applied would be drawn downwardly as the sheet of material moves vertically and upwardly. After the lacquer has been applied initially to one surface of the strip of material 16 the strip of material will be drawn upwardly to the drying hood 18 and outwardly through the drying trough 20, then returning through the drying hood. The strip of material then passes upwardly so that its length 16e will pass through the fountain unit 35 in an upwardly direction of travel, after which the strip of material 14 will pass downwardly around the various idler rollers and eventually be wound upon the reel 54. During these operations the rollers 28 and 44, as well as the reel 54,

may be positively driven and if desired additional rollers may be driven in order to insure proper feed of the strip 16 through the apparatus.

It will thus be seen that the structure here disclosed provides simple and effective means whereby a sheet of material may be fed and a continuous layer of coating material may be applied thereto in a manner to insure that it will be spread uniformly over a selected area of the surface of the sheet of material, that it may be spread in a uniform thickness thereover, and that if desired a coating may be applied readily to both sides of the sheet of material.

While we have shown the preferred method and the preferred apparatus for carrying out our invention, it is to be understood that various changes might be made in the steps of the method or the combination of the parts of the apparatus without departing from the spirit of our invention as claimed.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A device for applying a coating of liquid to the surface of an article which comprises a nozzle structure disposed transversely of the surface, said nozzle structure having a longitudinal slotted opening extending the width of the surface to be treated, the nozzle and the article having relative movement with each other whereby the liquid may be spread throughout the length of the article as said movement takes place, means for disposing the nozzle mouth at an angle to the surface to be treated and contacting therewith along the side from which the surface advances, whereby the effective opening of the nozzle may be varied to vary the thickness of the coating of liquid applied to the surface of the article, said angle of inclination extending from a point of contact between the nozzle and the surface along one side of the nozzle opening in an outwardly flaring direction whereby a V-shaped feed space will be formed, the outwardly flaring angle being on the side of the nozzle in the direction of the movement of the article with relation thereto, and means for varying said angle.

2. A device for applying a coating to a continuous sheet of material which comprises winding means off of and onto which a sheet of material may be unwound and wound, means directing the sheet of material in an upward vertical path of travel, an applying nozzle at a point in said vertical path of travel, said nozzle comprising a body portion extending transversely of the sheet of material and formed with a discharge slot representing the width of the area onto which the coating is to be applied, the nozzle being supported so that the lower edge of the nozzle adjacent the discharge slot contacts with the vertically moving material, and the upper edge of the nozzle adjacent the discharge slot is spaced therefrom whereby a V-shaped discharge throat will be formed between the end face of the nozzle and the surface being treated, thus permitting the flow of liquid from the nozzle and allowing it to spread upon the sheet of material as the material moves vertically.

3. A device for applying a coating to a continuous sheet of material which comprises winding means off of and onto which a sheet of material may be unwound and wound, means directing the sheet of material in an upward vertical path of travel, an applying nozzle at a point in said vertical path of travel, said nozzle comprising a body portion extending transversely of the sheet of material and formed with a discharge slot representing the width of the area onto which the coating is to be applied, the nozzle being supported so that the lower edge of the nozzle adjacent the discharge slot contacts with the vertically moving material and the upper edge of the nozzle adjacent the discharge slot is spaced therefrom whereby a V-shaped throat will be formed between the end face of the nozzle and the surface being treated, thus permitting the flow of liquid from the nozzle and allowing it to spread upon the sheet of material as the material moves vertically, and means for adjustably setting the nozzle to obtain a desired variation in the width of the V-shaped discharge throat.

4. A device of the character described comprising means for constantly feeding a sheet of material to be coated vertically, a nozzle structure adjacent thereto having a horizontal slot, the lower lip of which contacts the sheet of material and the upper lip of which is spaced therefrom, a reservoir containing a supply of coating material, a pump drawing the material therefrom, a pipe extending vertically to a height above the level of the nozzle, a connection between the nozzle and the pump at a point lower than said height whereby coating material may be pumped from the reservoir into said pipe and will flow into the nozzle under the pressure of the accumulated head of material, and a return pipe connected with the upper end of said first named pipe, whereby continuous circulation of the material may be carried on in the event flow from the nozzle is interrupted.

5. A device for applying a fluid to a surface to be treated which comprises means for feeding a sheet of material upwardly in a vertical path of travel, a horizontal nozzle structure disposed transversely of said sheet of material, said nozzle structure including an outer cylindrical housing element formed with a longitudinal slot therethrough, the horizontal edges of said slot being provided with protruding lip portions which may be moved toward or away from the surface of said sheet of material as the cylindrical member rotates on its horizontal axis and whereby rotation to move the upper lip out of contact with the sheet of material will permit coating material to flow from the nozzle opening and onto the upwardly moving surface of the sheet, an inner tubular cylindrical member mounted within the first named cylindrical member and being formed with a nozzle opening therethrough and whereby when the nozzle openings in the two members are rotated to register coating material from the second named tube may flow through said nozzle openings, means for rotating said cylindrical members around their common longitudinal axis and setting them with relation to each other, means for rotating the assembled nozzle structure around said common longitudinal axis and setting the same whereby the lips of the nozzle opening will be selectively disposed with relation to the surface of the sheet of material being coated, and means for continuously supplying coating material to a nozzle structure.

SAMUEL H. BERCH.
GEORGE PIERETTI.