April 2, 1957 D. G. WILLIAMSON ET AL 2,787,242

COATING APPLICATOR AND METHOD

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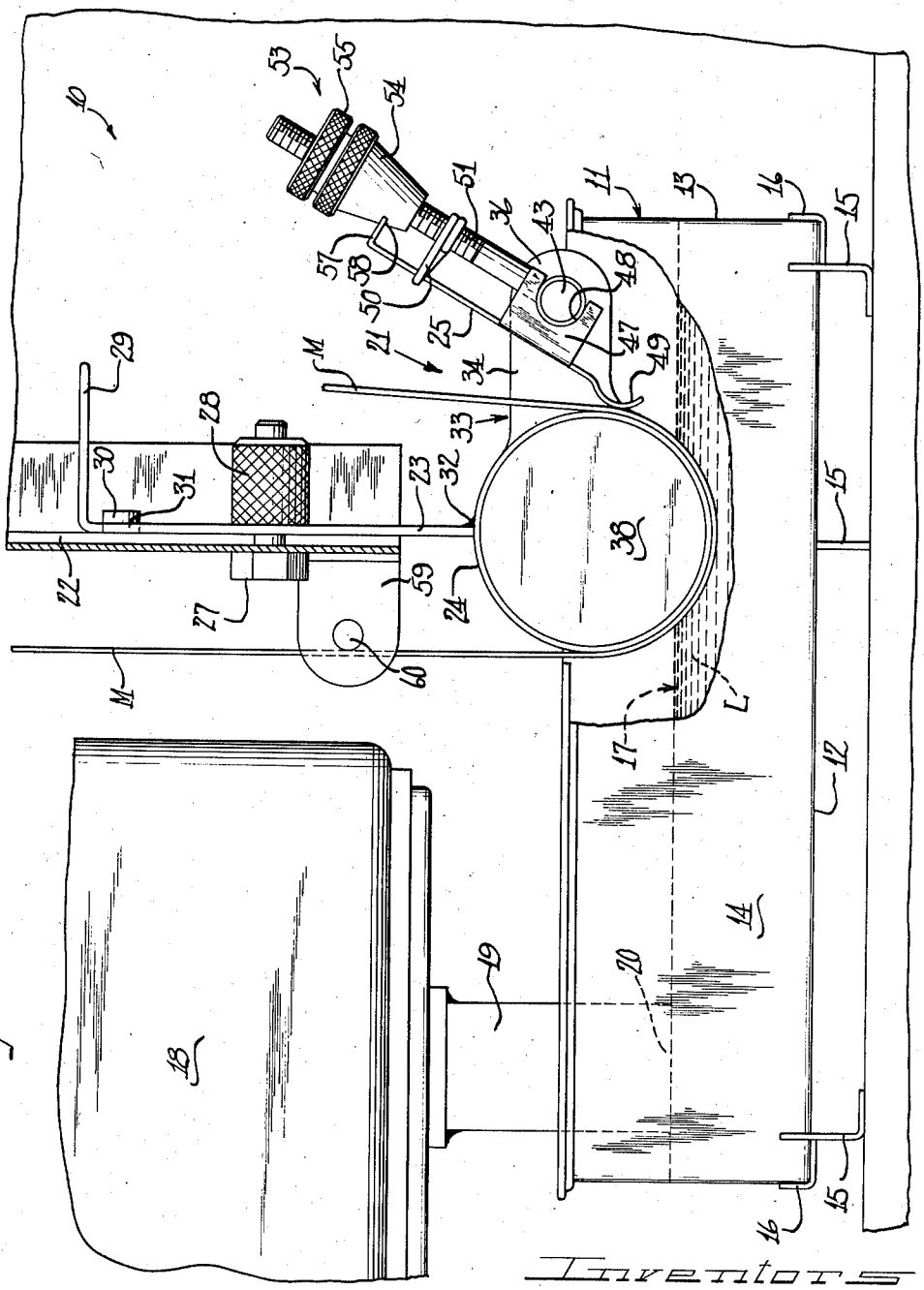


FIG. 1

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Fig. 4

Fig. 3

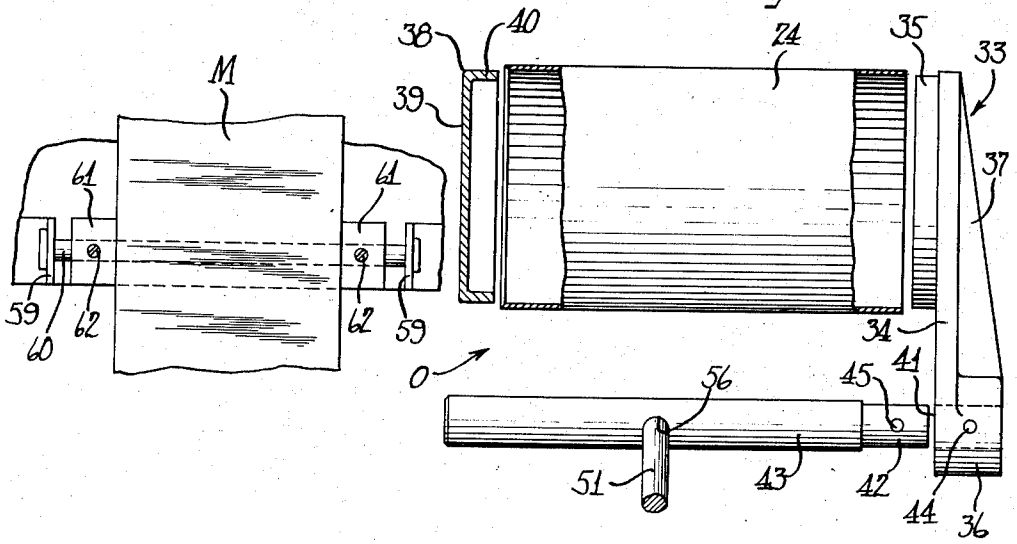
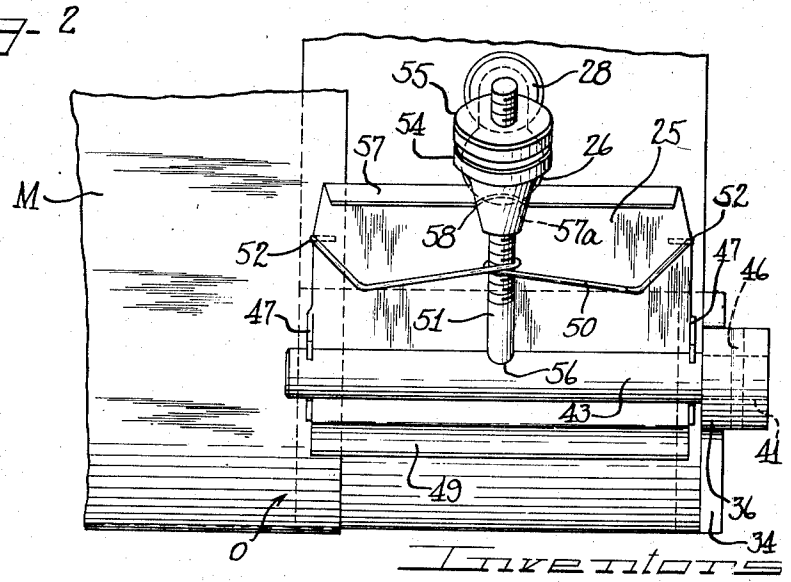


Fig. 2



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COATING APPLICATOR AND METHOD

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Application September 30, 1954, Serial No. 459,272

3 Claims. (Cl. 118—126)

This invention relates to an applicator for and a method of applying a liquid to flexible strip material. The applicator of our invention can be used for applying coatings of various types, including decorative, protective and adhesive coatings, or the liquid to be applied may be an activating liquid for remoistening or solvent-activating an already coated flexible strip.

The applicator of our invention includes means defining a reservoir for the liquid to be applied and an applicating unit or sub-assembly. The applicating unit or sub-assembly comprises a non-rotatable member providing a stationary arcuate surface normally extending into the reservoir, and a doctor blade pivotally mounted on said non-rotatable member for movement toward and away from the arcuate surface. The doctor blade has a curved or rounded strip-engaging end portion or foot which is constantly and resiliently biased or urged toward the surface of the stationary arcuate surface on the side thereof that the flexible strip material emerges from the reservoir. Guiding means are provided for directing the flexible strip into contact with the stationary or non-rotatable arcuate surface of the sub-assembly. The strip is initially lapped or threaded around the underside of the arcuate surface and between the arcuate surface and the doctor blade, after which the sub-assembly is mounted in the applicator with the arcuate surface partially immersed in the reservoir of liquid. The spring-urged or resiliently biased doctor blade serves the purpose of spreading and gauging the coating or film applied to the flexible strip as it is drawn past the doctor blade.

One of the various uses of our applicator is in connection with the application to strips of flexible material, such as paper, cloth, and the like, of a pressure-sensitive adhesive composition. Our device has proved to be very satisfactory for the making, right on the job, of pressure-sensitive tape, so that it can be made as it is needed and used on the spot, without the necessity of winding the tape into rolls, spooling or packaging the same. The cost saving is considerable.

It is therefore an important object of our invention to provide an applicator of novel and improved construction for the application of liquids, either as coatings, films, or activating solvents, to flexible strip material.

It is a further important object of this invention to provide an applicator through which flexible strip material can be manually drawn and the strip automatically treated on one side with the liquid while the other side of the strip remains untreated.

It is a further important object of this invention to provide an applicator for use on-the-job and by means of which flexible strip material drawn therethrough is conveniently and satisfactorily treated to the desired extent without requiring more than the simplest type of adjustments, if any.

It is a further important object of this invention to provide a method of treating flexible strip material with a liquid while the strip material is held under tension in contact with a stationary arcuate surface submerged within a body of the treating liquid, and of controlling the amount and distribution of the applied treating liquid as the strip emerges from the reservoir of liquid and while still in contact with the arcuate stationary surface.

Other objects, features and advantages of this invention will be readily apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying sheets of drawings, in which:

Figure 1 is a side elevational view of the coating applicator of the instant invention with parts broken away and parts in section;

Figure 2 is an end elevational view of the applicating unit or sub-assembly;

Figure 3 is an exploded view illustrating the preferred means employed in mounting the doctor blade on the stationary arcuate surface, and;

Figure 4 is a view illustrating the guide means for guiding the strip material into accurate engagement with the stationary arcuate surface.

The applicator of our invention, which is generally indicated by the reference numeral **10**, comprises a reservoir for a liquid and an applicating unit or sub-assembly. The reservoir **11** consists of a generally rectangular vessel or tank having a bottom member **12** and parallel, opposed end and side walls **13** and **14**, respectively. If desired, a suitable cover member may also be employed on the reservoir **11**. A cover, however, is not necessary for the proper functioning of the applicator and is optional, depending upon the environment in which the applicator is to be used. The reservoir **11** is supported by suitable supporting means such as L-shaped legs **15** having laterally extending, L-shaped brace arms **16** formed integrally therewith.

A suitable liquid L, with which the flexible strip material is to be coated, is retained in the reservoir **11** at a predetermined, substantially constant level as at **17**.

The liquid L is fed to the reservoir **11** from an auxiliary reservoir **18** by means of a cylindrical filling tube **19**. As shown in Figure 1, the auxiliary reservoir **18** is preferably located directly above and to one end of the reservoir **11**. The auxiliary reservoir **18** may be of substantially any suitable size and shape, and may be mounted in any desired manner. The cylindrical filling tube **19**, which delivers the liquid L to the reservoir **11**, also acts in a well-known manner in maintaining a substantially constant level of the liquid L in the reservoir **11**. That is, the lower end **20** of the filling tube **19** determines the level **17** of the liquid in the reservoir.

The applicating unit or sub-assembly, indicated generally at **21**, is removably mounted on a suitable depending support plate **22**. The applicating unit or sub-assembly **21** consists essentially of an upright plate **23**, a non-rotatable arcuate surface, or roll **24**, and a doctor blade **25**.

The plate **23** has a centrally positioned keyhole slot **26** formed therein. The plate **23** is detachably mounted to the depending support plate **22** by means of a suitable bolt, stud or the like **27**, having a cylindrical, knurled pressure-exerting nut **28** threadedly engaged on the bolt. The top end portion of the plate **23** is bent outwardly

to provide a laterally extending flange 29 for grasping the plate 23 when it is to be detached from the support plate 22.

A pilot pin 30 is integrally mounted to the depending support plate 22. The upright plate 23 of the applicating sub-assembly 21 has a suitable aperture as at 31 formed therein for receiving the pilot pin 30. The aperture 31 is formed at a predetermined position. This predetermined position is such that when the sub-assembly 21 is mounted on the depending support plate 22 the roll 24 will be submerged in the liquid L to just the proper depth to assure a proper coating of the strip material employed.

The stationary arcuate surface 24 preferably comprises a hollow cylinder or roll. If desired, however, the cylinder 24 may be solid, but for reasons of economy and weight, it is preferably hollow. The cylinder roll or stationary arcuate surface 24 is secured to the plate 23 by welding or the like as at 32. By "stationary" is meant that the roll, or arcuate surface 24 is non-rotatable, as distinguished from rolls or other rotatable arcuate surfaces which have been commonly used heretofore in coating applicators. This provision of the stationary or non-rotatable roll such as 24, as opposed to rotatable rolls, is not merely arbitrary, but rather performs a unique and novel function, as will be more clearly brought out as the disclosure progresses.

Means are provided for mounting the doctor blade 25 on the arcuate surface 24. In the embodiment shown in Figure 3, such means comprise a cantilever structure including the stationary roll 24, a lateral support member 33 and a doctor blade supporting pin 43. The support member 33, which is preferably cast from a suitable metal, includes a generally tapered or angular body portion 34, a laterally projecting circular roll-engaging portion 35 on one end thereof, a boss 36 on the other end and a longitudinally extending tapered reinforcing rib 37 formed integrally with the body portion 34.

The circular roll-engaging portion 35 is of a diameter substantially equal to or slightly smaller than the inner diameter of the hollow roll 24. The support member 33 is integrally mounted on the roll 24 by sweating or brazing the roll 24 onto the circular roll-engaging portion 35 which is inserted into the roll 24.

A closure plug 38 is provided for sealing the end of the roll 24 opposite the end on which the support member 33 is mounted. The closure plug 38 comprises a flat circular portion 39 and an annular flange portion 40 formed integrally therewith. The closure plug 38 may be cast or may be stamped from a suitable metal. The outer diameter of the plug 38 at the flange 40 is substantially equal to or slightly smaller than the inner diameter of the hollow roll 24. The plug 38 is mounted in the roll 24 by brazing or sweating.

The boss 36 of the support member 33 has a bore 41 formed therein for receiving the stepped end 42 of a doctor blade supporting pin 43. Aligned apertures 44, 44 are formed on the top and bottom surfaces of the boss 36 for alignment with a bore 45 formed in the stepped end 42 of the supporting pin 43. A locking pin 46 engages the aligned apertures 44, 44 and the bore 45 and firmly holds the support pin 43 against axial and radial movement.

The doctor blade 25 comprises a substantially rectangular plate having a width just slightly less than the length of the roll 24. It will be realized from the description of the function of the doctor blade 25, however, as will be more apparent as explained hereinafter, that the width of the doctor blade 25 may be varied depending upon the width of the flexible strip being coated. The doctor blade 25 is pivotally mounted on the pin 43 by means of laterally extending collars 47 formed integrally with the doctor blade 25. The collars 47 have semi-circular or arcuate cut-out portions 48 which pivotally engage the support pin 43.

The lower end of the doctor blade 25 is preferably bent in a rounded or curved fashion to form a strip-engaging convex portion or foot 49. The function of this curved strip-engaging end portion 49 will be more clearly dealt with in describing the operation of the coating applicator.

This curved strip-engaging end portion 49 is constantly and resiliently biased or urged toward the roll 24 by a spring loaded pressure. This spring loaded pressure is exerted by a clip-type spring 50 which is spirally wound around a threaded shaft 51 and is connected to the sides of the doctor blade 25 by means of hooks formed on the ends of the spring 50, as at 52 and holds the doctor blade 25 on the support pin 43.

The threaded shaft 51, provides supporting means for an adjustment member for regulating the pressure exerted by the doctor blade toward the roll 24. This adjustment member, indicated generally at 53, comprises a frusto-conically-shaped adjustment nut 54 and a lock nut 55. Both nuts 54 and 55 are threadedly engaged on the shaft 51 with the lock nut 55 being positioned beyond the adjustment nut 54. The lock nut 55 can be turned down tightly against the adjustment nut 54 to lock said adjustment nut 54 securely in place. Both nuts are knurled to provide good finger-engaging friction when being turned. The shaft 51, is welded, braised, or otherwise suitably mounted in a bore formed in the pin 43 as at 56.

As seen best in Figure 1, the curved strip-engaging end portion or foot 49 of the doctor blade 25 is normally constantly and resiliently biased or urged in a clockwise direction by the spring 50 toward the roll 24. In this manner, the strip-engaging portion 49 is effectively held against a strip of flexible material M interposed between the roll 24 and the doctor blade 25. The amount of this spring loaded pressure exerted by the strip-engaging portion 49 may be regulated by the adjustment nut 54. As seen in Figures 1 and 2, the upper edge portion of the doctor blade 25 is bent outwardly to form a laterally extending flange 57. An arcuate cut-out portion 57a of the free edge portion of the flange 57 abuts against the outer peripheral surface of the downwardly tapering or frusto-conically shaped surface of the adjustment nut 54 as at 58. The resilient pressure exerted by the spring 50 on the doctor blade 25 urges the curved strip-engaging portion 49 of the doctor blade toward the stationary arcuate surface 24 in a clockwise direction, causing the flange 57 to be forced against the tapered surface of the adjustment nut 54. By turning the adjustment nut 54 in the proper direction so that it is advanced downwardly on the shaft 51, it is possible to exert a counter-leverage or pressure on the doctor blade 25 in opposition to the clockwise pressure exerted by the spring 50. For, as the adjustment nut 54 is advanced downwardly on the shaft 51, it exerts or produces a camming effect on the flange 57. That is, as the adjustment nut 54 is advanced downwardly, the flange portion 57 of the doctor blade 25 rides upwardly and outwardly in a counter-clockwise direction on the tapered surface of the nut 54. Thus, by properly turning the adjustment nut 54 upwardly or downwardly on the shaft 51, one may carefully and accurately regulate and adjust the pressure exerted by the curved strip-engaging portion 49 toward the roll 24 and against the strip of flexible material M.

In initially operating the coating applicator of the instant invention, the following procedure is employed:

First, the nut 28 is threaded off the bolt 27 and the applicating sub-assembly 21 is detached from the pilot pin 30 and the bolt 27 and removed from the applicator 10.

A strip of the desired flexible material M, which is obtained from a suitable source (not shown), such as a roll of flexible strip material retained in an elevated position above the applicator, is then looped under the bottom edge and upwardly of the depending support plate 22.

The adjustment nut 54 is then threaded down to force the curved foot portion 49 of the doctor blade 25 away from the roll 24, to form a gap between the doctor blade and roll. The loop of flexible material M is then passed or slipped over the roll 24 into said gap from the open end of the sub-assembly 21 shown generally at O. The strip M is thus looped or lapped around the roll 24 and passes between the doctor blade 25 and the roll 24.

The restraining force of the adjustment nut 54 is then released and the doctor blade is adjusted by means of the nut 54 so that the curved strip-engaging end portion 49 of the doctor blade 25 is maintained at a predetermined spaced distance from the roll 24. In this manner the liquid L is spread evenly on the strip M and a uniform thickness of the layer of liquid L is maintained along the entire strip M thus coated. As is readily seen, the thickness of the liquid L is controlled by the space between the roll 24 and the curved end portion 49 of the doctor blade 25. This distance, in turn, is controlled and adjusted by the nut 54.

Next the sub-assembly 21 is mounted on the depending support plate by aligning the pilot pin 30 with the aperture 31 and the bolt 27 with the key hole slot 26. The sub-assembly 21 is then held rigidly in place by threadedly engaging the retaining nut 28 on the bolt 27.

In this mounted position the strip M is held snugly against the roll 24. The roll 24, in turn, is submerged into liquid L just to the proper depth to ensure a complete coating of the strip M without unduly coating the closed ends of the roll 24.

Means are provided for guiding the movement of the strip M into engagement with and around the roll 24. As shown best in Figures 1 and 4, such means include parallel ears or tabs 59 having a bar or pin 60 mounted therebetween. Guide collars 61 in the form of movable discs are slidably mounted on the bar 60. Each of the guide collars 61 is provided with a set screw 62 allowing said collars to be coaxially adjusted and set to accommodate the guidance of flexible strips of varying widths. In this manner the strip is always properly aligned with the arcuate surface of roll 24; preventing twisting, tearing or misalignment which might otherwise occur during the coating of the strip M.

The depth to which the roll 24, having the strip M lapped therearound, is immersed into the liquid L in reservoir 11 is not critical, provided that there is sufficient immersion to assure a complete and continuous coating of the strip M with the liquid L as the strip M is drawn over the roll 24 through the liquid L and past the doctor blade 25. It will also be appreciated that the depth of immersion can vary with the viscosity and nature of the liquid L being employed and the properties of the strip M.

The depth to which the roll 24 can be immersed may be controlled by adjusting the position of the pilot pin and/or the level of the liquid L in the reservoir. The level 17 of the liquid L of course, can be easily regulated by raising or lowering the end 20 of the delivery pipe 19.

The strip M is preferably manually drawn through the applicator. It will be realized, however, that if desired, the strip M may be drawn through the applicator by mechanical means, such as a mechanically driven reel or the like. Also, if desired, or if required by the nature of the liquid L with which the strip M is coated, the strip M after being drawn through the applicator and coated with the liquid L may be led through suitable drying means to dry or otherwise process the coating of the liquid L on the strip M. The requirements for drying or the like, however, will vary depending upon the particular job and the nature of the liquid.

In the instant invention, the stationary arcuate surface of the roll 24 efficiently effects the coating of only one side of the strip M with the liquid L. The tension exerted on the strip M as it is drawn around the roll 24 and past the doctor blade 25 is primarily the result of the frictional sliding engagement between the surface of the strip M which is in contact with the surface of the stationary roll 24 and the hydraulic pressure of the liquid L exerted upwardly against the strip M. This engagement and hydraulic pressure provides a sufficiently tight seal to prevent the influx of the liquid L between the strip M and the roll 24. Accordingly, only the obverse or opposite side of the strip M, which is not in contact with the roll 24, comes into contact with and is coated by the liquid L.

As noted above, the prevention of influx of the liquid L between the strip M and the roll 24 is primarily a result of the tension exerted upon the strip M as it is drawn through the applicator. This tension, in turn, is produced by the stationary character of the roll 24, and is largely a product of the friction produced by the sliding engagement of the strip M over the stationary arcuate surface and the hydraulic pressure of the liquid L exerted upwardly against the strip. Accordingly, if the friction created by the sliding engagement of the strip M over the roll 24 were reduced or eliminated, the hugging pressure of the strip M against the arcuate surface would, likewise, be diminished. By the same token, if the tension on the strip M were reduced, the prevention of the influx of the liquid L between the strip M and the roll 24 would be correspondingly difficult, if not impossible, to prevent.

Heretofore, arcuate surfaces or rolls and the like employed in coating applicator mechanisms similar to the instant invention have always been rotatable, rather than stationary surfaces. In all such prior applicator structures, it was necessary to provide supplementary or additional tensioning means to prevent the influx of the coating liquid between the strip being coated and the rotatable or otherwise non-stationary arcuate surfaces over which the strip was drawn. These supplementary tensioning means were not only items of added expense, but also complicated the operation of the applicator and increased its size and weight. Also, in many instances, the supplementary tensioning means were somewhat difficult to control.

In the applicator of the instant invention, however, the novel function of the stationary roll 24 in preventing the influx of coating liquid L between the strip M and the roll minimizes the need for supplementary tensioning means, for the tension exerted on the strip M as it is fed off a supply roll and around the stationary roll 24 supplies a sufficient amount of tension. This results in a simpler construction which decreases initial cost, subsequent maintenance and upkeep and makes for a lighter weight structure which increases the portability of the applicator.

The doctor blade 25 having the curved strip-engaging foot or end portion 49 formed thereon evenly spreads the liquid L as a uniform layer on the strip M and accurately gauges the thickness of said layer on said strip. By means of the novel adjustment nut 54 acting against the resiliently biased doctor blade 25 it is possible accurately to gauge the thickness of the layer of the liquid L on the strip M regardless of the viscosity of the coating liquid employed. The rounded structure of the curved strip-engaging end portion 49 leads and forces the liquid L into the nip between the strip-engaging foot 49 and the roll 24 and accurately determines the thickness of the layer of the liquid L. In the doctor blades employed heretofore in coating applicators similar to that of the instant invention, this desirable spreading and gauging by the doctor blade were not always possible, for previous doctor blades did not have curved or rounded strip-engaging portions. Rather, such doctor blades had straight, flat, or at the best, blunt strip-engaging end portions. Such straight strip-engaging edges tend to scrape the coating liquid off the strip. Accordingly, doctor blades employed heretofore did not always accurately gauge the thickness of the layer, and indeed, in some instances, would occasionally effect a scraping action which would remove the liquid from the strip, rather than aiding the coating of the strip with the liquid.

In addition, the doctor blade 25 of the instant applicator may be easily removed or dismounted by simply removing the spring 50. This facilitates easy cleaning of the structure.

Another feature lies in the fact that the entire applicating sub-assembly 21 may be removed from the applicator 10 while the strip M is being lapped around the roll 24. As compared to standard applicators, wherein the strip must be threaded through the adhesive during loading, the strip M in the present structure does not touch the adhesive while the apparatus is being set up. This cleaner and simpler method of lapping the strip around the roll while the sub-assembly 21 is dismounted results in less tape or strip material being wasted by the inadvertent coating of the tape on both sides during the loading procedure.

The applicator of the instant invention is capable of operating with liquids of various types and characteristics. A few examples of the various categories into which the liquids, or at least the flowable treating materials may fall are: coatings of a decorative, protective, or adhesive character; and surface activating or deactivating applications, which may include the remoistening or solvent activating of films or coatings already present on the flexible strip, or for deactivating other types of surfaces. An ordinary gummed strip may, for instance, be drawn through our applicator for moistening with water, which would then be the liquid L within the reservoir 11.

Since our applicator may find its greatest use in connection with the application of adhesive coatings to flexible strip material, we shall briefly mention some of the various types of liquid ahesives which may be used. These would include water soluble adhesives of the dextrin, starchy, casein, animal glue or soluble gum or resin type; colloidal solutions of animal glue, starch, or the like; colloidal dispersions and emulsions, with either water or an organic solvent as the continuous liquid phase; resin solutions; hot melts or thermoplastic resins, waxes and elastomers, or mixtures thereof; and heat activating compositions, which may be combinations of resins having latent adhesive properties that are developed by the application of heat.

Some common adhesive compositions of the water soluble type are represented by the following:

Example I

Materials:	Percent by weight
Dextrin	30.0
Borax	5.0
Sodium hydroxide	0.6
Preservative	0.2
Water	64.2

Example II

Materials:	Percent by weight
Casein	16.0
26° Bé. ammonia	10.0
Preservative	0.5
Water	73.5

Example III

Materials:	Percent by weight
Gum arabic	40.0
Preservative	0.2
Water	59.8

Example IV

Materials:	Percent by weight
Animal glue	40.0
Liquefier, such as calcium chloride	10.0
Preservative	0.5
Water	49.5

Example V

Materials:	Percent by weight
Rubber	15.0
Plasticizer	15.0
Naphtha	70.0

Among the self-supporting flexible materials that may be used in strip, ribbon, tape, or other more or less continuous web form may be mentioned paper, cloth, plastic, metal, and wood veneer. The metal, of course, would be in the form of thin sheets, foil, or the like, and would include steel, aluminum and lead.

One of the advantages of our applicator and dispenser is that of being conveniently adapted for use with intermittently run equipment, such as for example in box making equipment, where the flexible strip material may be treated, coated or the like only as and when needed. It is not necessary, therefore, to use ready-made tape that must be moistened before being applied, or expensive ready-made pressure sensitive tape. The latter is relatively more expensive because of all of the added steps of spooling and packaging, and in some instances supplying special release surfaces to facilitate unwinding without de-lamination.

It will be apparent to those skilled in the art that we have now provided a new and improved applicator for applying liquid to a flexible strip material. It will also be appreciated that the applicator of this invention can be used for applying coatings of various types, including decorative, protective, and adhesive coatings, as well as for the application of activating liquids for remoistening or solvent activating an already coated flexible strip.

It will, of course, be understood that various details of the invention may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

We claim as our invention:

1. An applicator for applying a liquid to a flexible backing strip, which comprises a reservoir for said liquid, a sub-assembly including a non-rotatable member providing an arcuate surface normally extending into said reservoir and a doctor blade supported from said member and pivotally mounted for movement toward and away from said arcuate surface, said doctor blade having a curved strip-engaging end portion thereon, means constantly and resiliently biasing said end portion toward said arcuate surface for evenly spreading said liquid on said strip and for gauging the thickness of said layer on said strip, and a threaded adjustment member for adjusting the pressure exerted by said doctor blade toward said arcuate surface.

2. An applicator for applying a liquid to one side only of a flexible backing strip which comprises a reservoir for said liquid, a detachable support plate having a non-rotatable member providing an arcuate surface mounted integrally thereon normally extending into said reservoir and a doctor blade supported from said member and pivotally mounted for movement toward and away from said arcuate surface, said doctor blade having a curved strip-engaging end portion thereon, means constantly and resiliently biasing said end portion toward said arcuate surface for evenly spreading said liquid as a layer on said strip and for gauging the thickness of said layer on said strip, and threaded adjustment means for adjusting the pressure exerted by said doctor blade toward said arcuate surface.

3. An applicator for applying a liquid to one side only of a flexible backing strip which comprises a reservoir for said liquid, a detachable sub-assembly including a support plate having a non-rotatable member providing an arcuate surface mounted integrally thereon normally extending into said reservoir and a doctor blade supported from said member and pivotally mounted for movement toward and away from said arcuate surface, said doctor

blade having a curved strip-engaging end portion thereon, means constantly and resiliently biasing said end portion toward said arcuate surface for evenly spreading said liquid as a layer on said strip and for gauging the thickness of said layer on said strip, means for adjusting the pressure exerted by said doctor blade toward said arcuate surface, and guide means above and adjacent said arcuate surface for guiding said flexible strip over said arcuate surface through said reservoir and past said doctor blade.

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