Sept. 17, 1963 C. H. SCHNEIDER ETAL 3,104,182

APPARATUS FOR CONTROLLING EDGE BEADS

Filed April 28, 1961 5 Sheets-Sheet 1

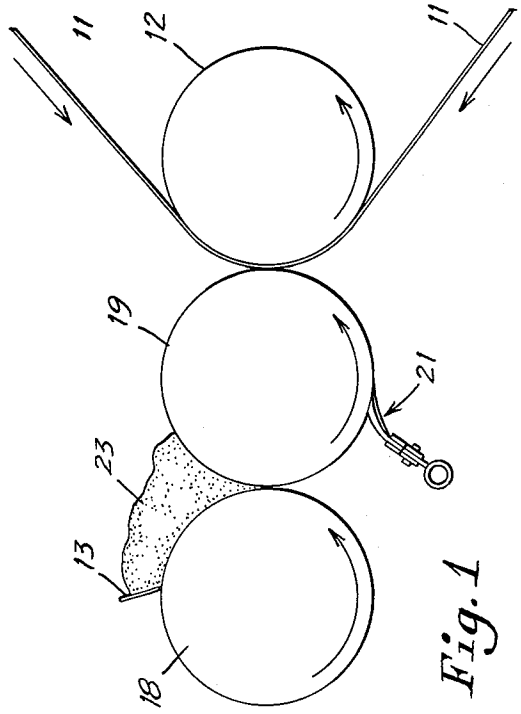


Fig. 1

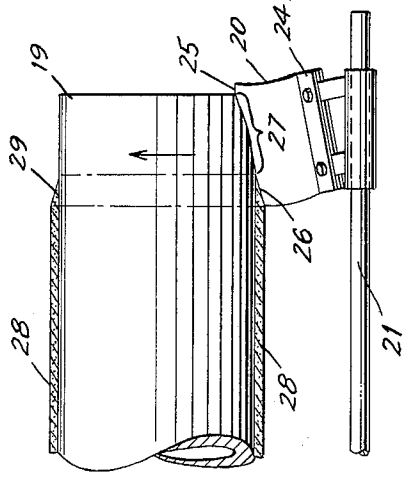


Fig. 4

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APPARATUS FOR CONTROLLING EDGE BEADS

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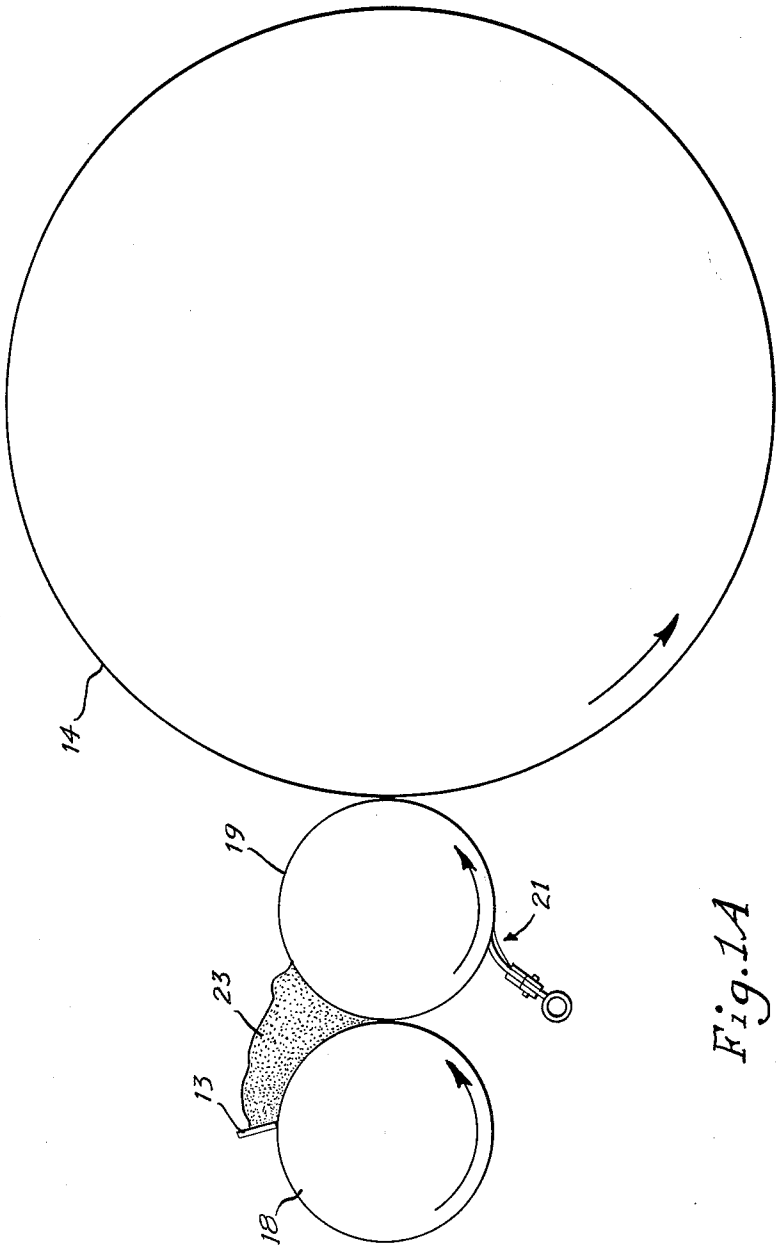


Fig. 1A

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APPARATUS FOR CONTROLLING EDGE BEADS

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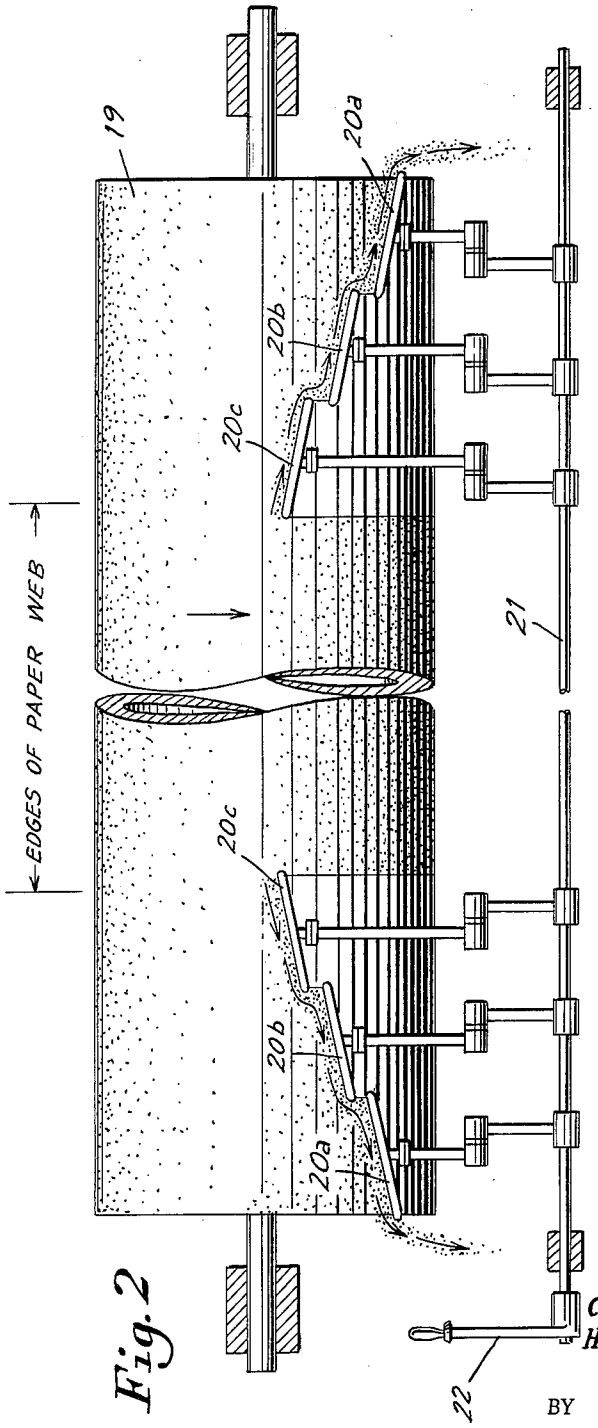
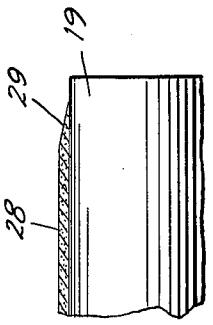
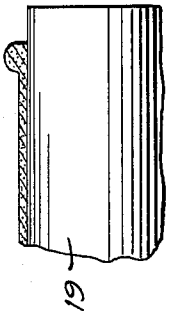


Fig. 2



PRESENT INVENTION

Fig. 6



PRIOR ART

Fig. 5

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APPARATUS FOR CONTROLLING EDGE BEADS

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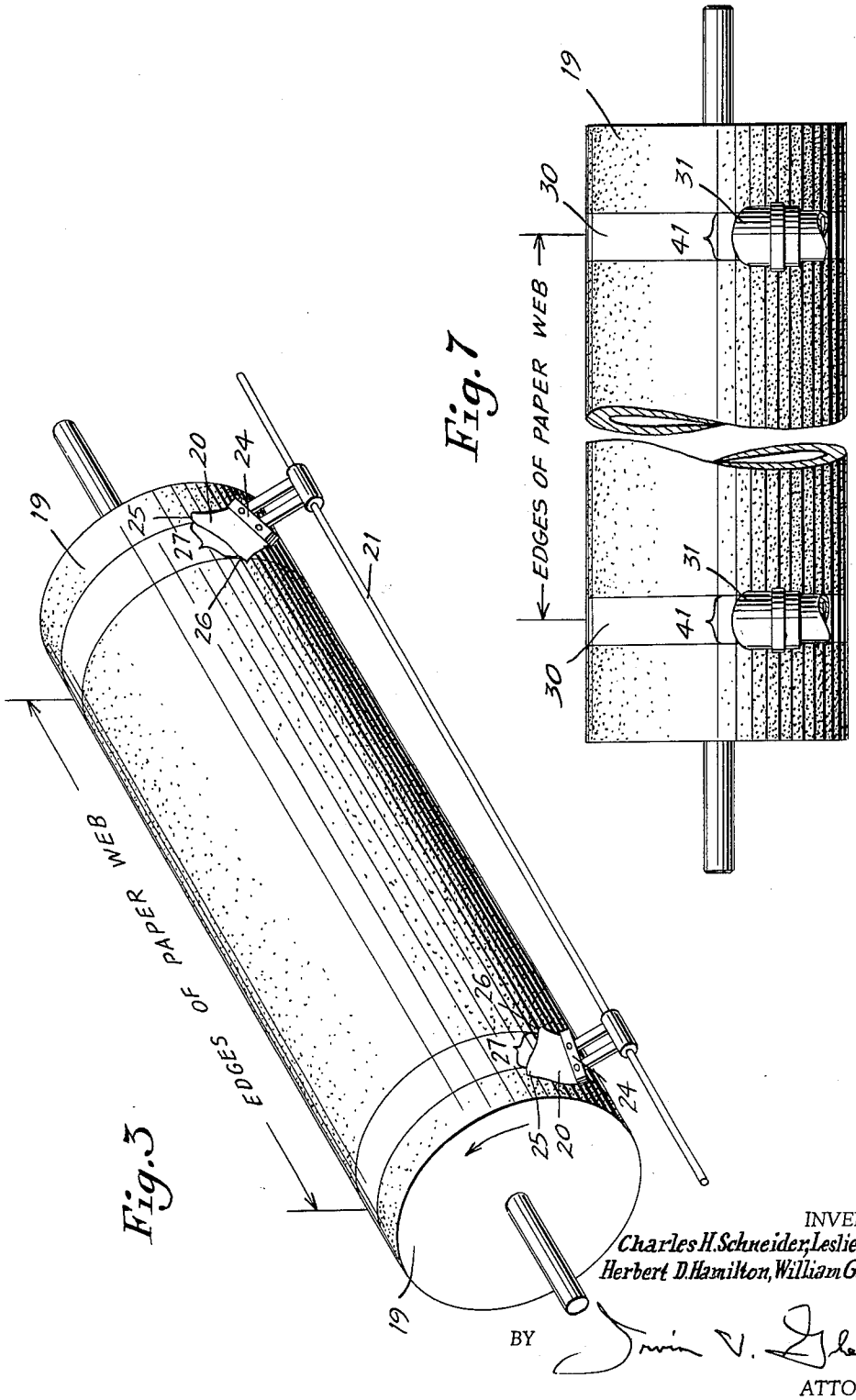


Fig. 3

Fig. 7

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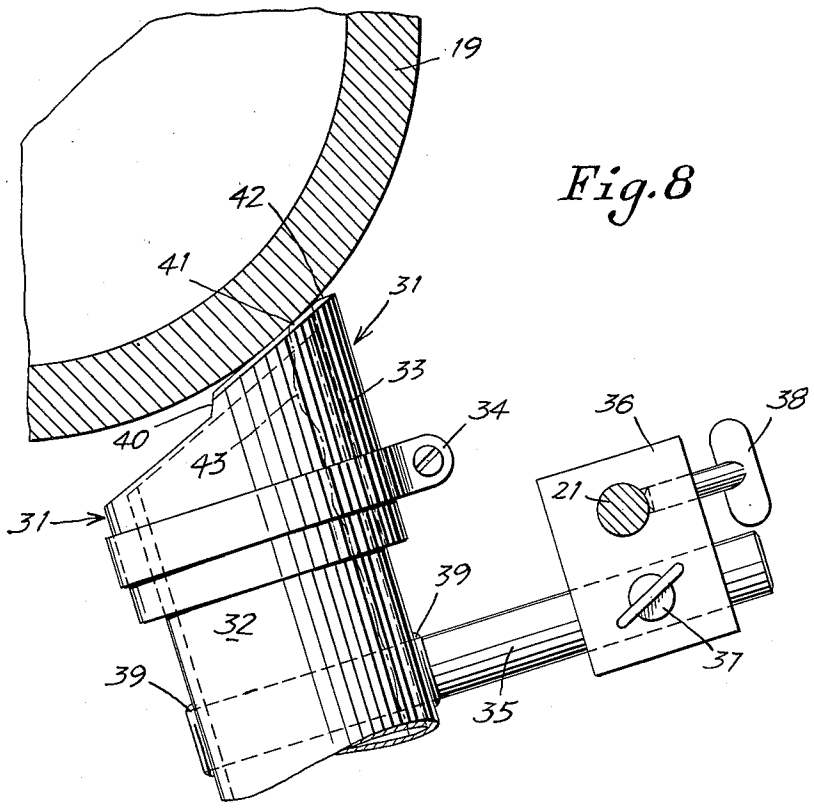


Fig. 8

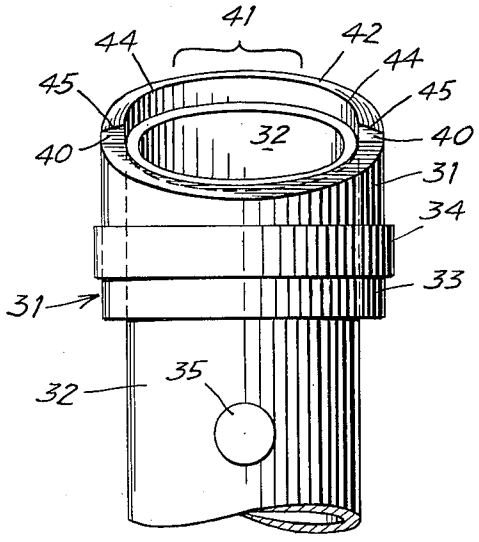


Fig. 9

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APPARATUS FOR CONTROLLING EDGE BEADS

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Filed Apr. 28, 1961, Ser. No. 106,361
9 Claims. (Cl. 118—204)

The present invention relates to apparatus for removal of material from a portion of a cylindrical surface, and more particularly to means for doctoring paper coating material from a coating roll so as to minimize or eliminate thickened ridges or beads of coating material immediately adjacent the doctored area.

Heretofore, various means have been suggested for removal of paper coating material from the ends of coating rolls so as to limit the width of coating applied by the roll to a width equal to or preferably slightly less than the width of the paper web to which the coating is subsequently applied. Conventional doctoring means of the prior art, while effective in removing coating material from the roll surface in the area of contact between the doctor and the roll, almost invariably leave a thickened ridge or bead of coating material immediately adjacent the doctored area. These so-called edge beads are transferred to the paper web, along with the main area of the coating.

The greater thickness of coating in the edge bead requires more setting or drying time than the coating on the main area of the web, and if the coated web is wound into a roll as soon as setting or drying is accomplished for the main area of the coating on the web, the edge beads are incompletely set or dried, and cause adjacent wraps of the web in the wound roll to stick together by reason of the adhesive component present in the coating material. On the other hand, if the setting or drying is continued to the point where the greater thickness of the edge bead is completely set or dried, the coating in the comparatively thick edge bead may become brittle and crack as the web is wound onto a roll. Such cracking can weaken or crack the edges of the paper web, with resultant web breaks in subsequent operations, such as calendering, printing and the like.

In any event, the greater setting or drying time required for the relatively thick edge bead requires a slower operating speed on the coating machine, with its attendant lower productivity and higher operating cost.

The process for producing highly glossed mineral coated paper generally known in the trade as cast coating, is particularly susceptible to reduced speed and efficiency attributable to edge beads. Such relatively thick ridges of coating will frequently leave deposits on the casting surface which tend to build up, by repeated revolutions of the casting drum or belt, to the point where the machine must be stopped and the accumulations laboriously removed by hand. Furthermore, any deposits of coating material on the casting surface beyond the edges of the paper web must be continually removed; otherwise this coating tends to build up by repeated application and become tightly adherent to the casting surface, fouling the surface and rendering it unfit for use and causing serious difficulties when the web shifts laterally or a wider web is to be coated. Prior attempts to continuously remove such coating material have not been wholly successful.

These and other deficiencies of the prior art are substantially overcome by the apparatus of this invention which limits the applied coatings to a width slightly less than the width of the paper web and avoids the formation of thickened ridges or edge beads of coating at the extremities of the coated area of the web.

Accordingly, it is an object of this invention to provide

an improved apparatus for avoiding the occurrence of edge beads of coating material in paper coating machines and/or operations.

Another and important object of the invention is to provide an improved apparatus for continuously producing high gloss cast surfaced mineral coated paper which overcomes the difficulties inherent in the prior art methods and which are characterized by relatively low cost and freedom from processing details.

Still another object of the invention is the provision of one or more doctoring means arranged in a novel manner with respect to an applicator roll in a papermaking and/or coating machine.

Other and more specific objects, as well as the novel characteristics of the apparatus which contribute jointly to the functional improvement, will appear hereinafter.

In the attached drawings:

FIGURE 1 is a diagrammatic view in side elevation showing apparatus constructed in accordance with and for practicing the present invention;

FIGURE 1*a* is a diagrammatic view in side elevation showing modified apparatus for practicing this invention;

FIGURE 2 is a schematic showing, partly broken away and partly in elevation, illustrating the action of certain doctor blades forming a part of this invention;

FIGURE 3 is a schematic perspective view of another and more simplified form of the apparatus shown in FIGURE 2;

FIGURE 4 is a diagrammatic elevational view, partly broken away, of one of the doctor blades of FIGURE 3, showing the partial helical shape of the line of contact of the end of the blade with the roll or cylinder surface;

FIGURE 5 is a greatly enlarged view, partly in section and partly broken away, showing the edge bead encountered through the use of prior art doctoring devices;

FIGURE 6 is a greatly enlarged view, partly in section and partly broken away, showing the tapered, wedge-shaped edge of a coating film resulting from the practice of this invention;

FIGURE 7 is a diagrammatic elevation of another embodiment of the present invention;

FIGURE 8 is a side elevation view, partly in section and partly broken away, of the embodiment of FIGURE 7; and,

FIGURE 9 is a front elevation view of the doctoring device shown in FIGURE 8.

Referring more particularly to the drawings, there is schematically shown in FIGURE 1 the principle employed in the present invention. Rolls **18** and **19** in conjunction with backing roll **12** serve to apply a fluent coating **23** onto the surface of a paper web **11**. Backing roll **12** supports web **11** and rotates in the direction of travel of the web as indicated by the arrows. The fluent coating **23** is maintained in a pool in the nip trough formed by metering roll **18** and applicator roll **19**. The coating system shown is a reverse roll system, with rolls **18** and **19** turning in the direction of the arrows. A conventional doctor blade **13** serves to retain the pool of coating **23** in the nip trough of rolls **18** and **19**. This coating apparatus is the subject of United States patent application Serial No. 50,635, filed August 19, 1960 (assigned to the same assignee as this invention), and forms no part of the present invention.

Referring to FIGURE 1*a*, **14** indicates a large diameter roll or drum which alternatively may be used for certain processes of producing cast surfaced mineral coated paper. In this arrangement, metering and applicator rolls **18** and **19** apply a film of fluent coating to the surface of roll or drum **14**. Such coating film is therafter transferred intact to a paper web at a point and by means not shown in the figure. Whether the described ap-

paratus illustrated by FIGURE 1 is used for applying coating films directly to a paper web, or to the surface of a casting roll or drum as shown by FIGURE 1*a*, the novel edge doctor means of this invention, indicated generally at **20**, may be used to considerable advantage.

As illustrated by FIGURE 2 of the drawings, there is mounted adjacent each end portion of the applicator roll **19** a group or series of doctor blades each of which is adjustably mounted upon supporting shaft **21** which shaft **21** is rotatable by means of a control arm **22** whereby all of the doctor blades may be moved into or out of contact with applicator roll **19**. In each group of doctor blades, the innermost blade **20***c* first comes into contact with applicator roll **19** to remove therefrom a portion of the fluid coating composition, indicated at **23** in FIGURE 1, which has been applied thereto. The next adjacent blade **20***b* is so arranged as to receive the fluid thus removed from roll **19** and at the same time to remove an additional portion of such fluid from roll **19**. The outermost doctor blade **20***a* is so arranged that it receives the fluid from intermediate blade **20***b* and at the same time removes the remainder of the fluid coating composition from the outermost or edge portion of roll **19**. Of course, it will be appreciated that instead of three doctor blades in each group as illustrated in FIGURE 2, there may be additional blades in each group, or only one of such blades may be utilized, depending on the demands of the particular coating operation.

One of the essential principles here involved is the provision of one or more of such doctor blades set at an angle to a generatrix of the applicator roll, and, in the case of multiple blades, arranged in consecutive overlapping circumferentially disposed paths with relation to the rotating surface of an applicator roll. While one single doctor blade might be arranged in contact with a certain end portion of a roll, the greater the width of such end portion, the greater the chances of inaccuracies in the proper contactual relationship between the edge of the doctor blade and the surface of the roll with which it is in contact. In those instances where an appreciable width of applicator roll end portion is to be doctored, the doctoring is preferably accomplished by utilizing a plurality of such doctor blades, thus making possible a greater accuracy in proper contact between the blade and the roll. By arrangement of such plurality of doctor blades in the manner shown in FIGURE 2, that is to say in overlapping contact with circumferential paths of travel of an applicator roll and further in such manner that, proceeding outwardly from the innermost blade, each adjacent blade is adapted to receive thereon the fluids removed from the roll by an immediately inwardly located blade while at the same time cleaning a portion of the roll in itself, the outermost of such blades being adapted to deliver the entire amount of liquid removed from the roll to a remote point for disposal.

The unique doctoring action of the doctor blades is best shown in FIGURES 3 and 4 wherein a single blade form of the invention is illustrated and indicates the bending or flexing of doctor blade **20** as it is urged against the surface of roll **19**. The curvature of the blade tip or end, remote from the clamping means, is a consequence of its conformity, over at least a portion of its width, to the curvature of the surface of roll **19**. The force pushing the blade tip against the roll, imparted by supporting shaft **21** and control arm **22**, FIGURE 2, causes the central portion of the blade tip to assume a screw or helical shape. The width of the central portion of the blade in actual contact with the roll is greater, the greater the force urging it against the roll, and, if such force is great enough, the entire width of the blade would bend to a helical shape at its tip. However, such high force is to be avoided when practicing this invention, as it is an important feature that the extremities of blade tip **25**, **26** do not engage the roll surface, although a central portion is so engaged as shown at **27**. The portion of blade tip **26**, which is not in direct contact with roll **19** extends at an acute angle to its projection on the surface of roll **19**, and, as roll **19**, carrying a film of coating, rotates past the blade in the direction of the arrow, FIGURE 4, the edge of the film of coating remaining on the roll is tapered or shaved as shown at **29**. The portion of blade **27**, in actual contact with roll **19** removes the coating material from a relatively narrow circumferential part of the end portions of roll **19**. It is only necessary that a circumferential band of clean roll surface be provided, and such band be located so that the edges of the paper web fall roughly in its center portion, as shown at **30** in FIGURE 7. The straight blade type doctors shown at **20** in FIGURE 3 may be used for this purpose, or doctors of the type shown in FIGURES 7 to 9 may be used to advantage to achieve this result.

Doctors of the type shown in FIGURES 7 to 9 are generally cylindrical in cross section, with one end cut at an angle to the long axis of the cylinder. Referring to FIGURE 8, the doctor is shown generally at **31**. A metal tube **32**, with its upper end cut at an angle to its long axis, is provided with a doctoring member **33** which is made of relatively stiff sheet material such as, for example, rubber, leather, plastic sheeting or the like. Doctoring member **33** is wrapped around tube **32** and secured to said tube as by clamp **34**. Rod **35** extends through diametrically aligned holes drilled in tube **32**, and is secured thereto as by welding as shown at **39**. Rod **35** extends through a hole in block **36**, and is adjustably secured therein by thumb screw **37**. The upper portion of block **36** is provided with a hole at right angles to rod **35**, through which extends supporting shaft **21**. Block **36** is adjustably secured to shaft **21** by thumb screw **38**. The arrangement of rod **35**, block **36** and supporting shaft **21** permits adjustment of the doctor into any desired position with respect to roll **19**.

The doctoring edge of doctoring member **33** extends slightly beyond the upper end of tube **32**, and has a cutaway portion **40** and a doctoring portion **41**. The outer lip of doctoring portion **41** is beveled slightly as shown at **42**. While doctoring member **33** may be made from tubular material such as rubber or plastic hose, it may also suitably be cut from flat sheet material and then wrapped around metal tube **32**. In either case, the doctoring member is fixed in position, relative to tube **32** by clamp **34**.

In operation, cylindrical doctor **31** is arranged to contact roll **19** along its doctoring portion **41**, whereby it it removes coating film from a cylindrical band around the periphery of roll **19**, as shown in FIGURE 7. The edges of the film of coating material on either side of the cleaned area or band are tapered, in the same manner as shown in FIGURE 6, and edge beads are not formed. The marginal edges of the paper web are free of coating, and, since no drying or setting occurs on backing roll **12**, the presence of fluid coating on the end portions thereof is without significance.

The coating fluid removed from the circumferential bands on roll **19** by doctor **31** flows by gravity down the inside of tube **32**, and is conducted to a point remote from the coating apparatus, as shown at **43** in FIGURE 8. It will be recognized, of course, that the line of contact of the cylindrical doctor **31** with coating roll **19** is not a screw curve, as described for blade type doctors supra, but will take the form of a somewhat flattened circular arc. Again, the tapering of the edge of film of coating material left on roll **19** is accomplished by portions of doctoring member **33** on either side of doctoring portion **41** of said member, as indicated at **44** and **45** in FIGURE 9. Portions **44** and **45** of doctoring member **33**, when in operating condition, make an acute angle with their

projections on the surface of roll 19, and have a shaving or plowing action on the film of coating fluid which tapers the edge thereof, and moves the portion of coating fluid removed by such plowing action toward the central portion 41 of doctoring member 33. From this point, gravity flow through tube 32 conducts the coating fluid to a remote point as aforesaid.

While but two embodiments of the invention have been shown and described herein, it will be readily apparent to those skilled in the art that many minor modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

This application is a continuation-in-part of United States Serial Number 730,377, filed April 23, 1958, now abandoned.

What is claimed is:

1. In a coating machine having a cylindrical roll carrying a film of fluid coating material on the surface thereof, a doctoring device for removing said coating material from an end portion of the surface of said roll comprising a doctoring member having a tip portion, the central part of which contacts said roll surface in a curved line, said member having portions forming acute angles with their projections on the surface of said roll whereby the edges of the film of coating material adjacent the doctored area of the roll surface are tapered toward a feather edge and free of thickened ridges of said coating material.

2. The doctoring device of claim 1 wherein the said doctoring member is a flat blade set at an angle to the generatrix of said roll and said line of contact of the central part of the tip portion of said blade with said roll surface is a curved line having a helical shape.

3. The doctoring device of claim 1 wherein the said doctoring member is of curvilinear tubular form, the tip portion of which is cut away at an angle to the axis of said cylinder.

4. In a coating machine, a doctoring device for removing coating material from an end portion of the surface of a cylindrical roll, comprising a flat flexible doctor blade set at an angle to the generatrix of the said roll, means for clamping said blade at said angle, and means to press said blade against said roll under sufficient pressure to cause said blade to deform at its tip into a partial helix, said blade tip not contacting said roll surface over its full width, whereby coating material is removed from said roll where said blade is in contact with said roll, and the edge of said coating material adjacent the area where said coating material has been removed is tapered toward a feather edge by the plowing action of the said blade at either edge of said blade.

5. In a coating machine having a cylindrical roll carrying a film of fluid coating material on the surface thereof, a doctor blade formed by cutting one end of a cylindrical doctoring member at an angle to the long axis of the cylinder, means for clamping said blade adjacent the surface of said roll, means to press said doctoring member in contact with said roll under sufficient pressure to cause said doctoring member to deform at its tip into a flattened curve, said blade tip having a cut away portion so that it contacts said roll surface over only a portion of its projected width whereby said film of coating material is removed from said roll where said doctoring

member is in contact with said roll and the edges of the film of said coating material adjacent the area where said coating material has been removed is tapered toward a feather edge by the plowing action of said doctoring member.

6. An apparatus of the character described comprising a frame, a cylindrical applicator roll mounted in said frame and having a pair of opposed end portions and an axis of rotation, two series of doctor blades carried by said frame, each series of doctor blades being disposed in contact with a respective end portion of said roll and having the doctor blades thereof disposed along the length of the respective end portion of said roll, each said doctor blade of each said series being set at an angle to the axis of rotation of said roll, each series of blades being so constructed and arranged that the blades thereof have side portions that overlap adjacent side portions of adjacent blades and are spaced one below the other in stair stepped relation around at least part of said roll, one said series of blades being set at an angle to the axis of rotation of said roll so as to move material removed from the surface of one said end portions of said applicator roll to the nearest end thereof, and the second said series of blades being set at a different angle to the axis of rotation of said roll so as to move material removed from the surface of the remaining said end portion of said applicator roll to the nearest end thereof.

7. Apparatus of the character described, comprising a frame, a cylindrical applicator roll mounted in said frame and having a pair of end portions and an axis of rotation, and two series of overlapping and stepwise disposed doctor blades carried by said frame, each series of doctor blades being disposed in contact with a respective end portion of said roll and having the doctor blades thereof disposed along the length of the respective end portion and so oriented angularly with respect to said axis of rotation of said roll as to move coating material respectively toward said respective end portions, whereby said doctor blades sequentially deliver doctored coating material laterally to the zone of a trailing doctor blade, the last doctor blade of each series extending at least to a point closely adjacent the respective end edge of said roll for removing accumulated doctored material from said roll at the respective end edges thereof.

8. An apparatus as set forth in claim 7 wherein each series of doctor blades includes a leading blade, at least one intermediate blade and a trailing blade whereby the coating removed by each blade of each series is transferred to a succeeding blade in the respective series of blades.

9. An apparatus as set forth in claim 8 wherein the trailing doctor blade of each series of blades extends beyond the respectvie end edge of said applicator roll.

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