Sept. 20, 1966 G. KRIKORIAN 3,273,535

TRAILING-BLADE-COATER INCLUDING ADJUSTABLE DRAG-BLADE

Filed Oct. 6, 1964 3 Sheets-Sheet 1

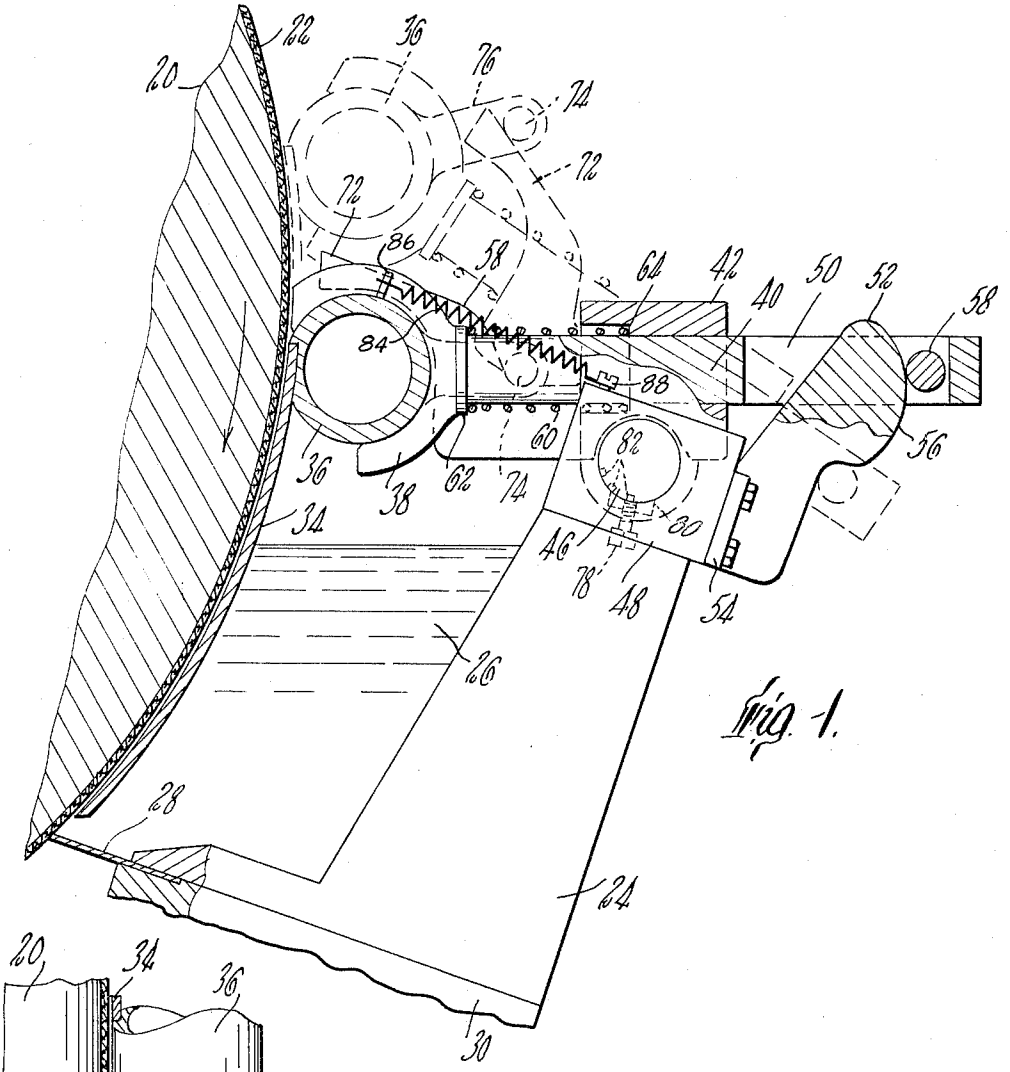


Fig. 1.

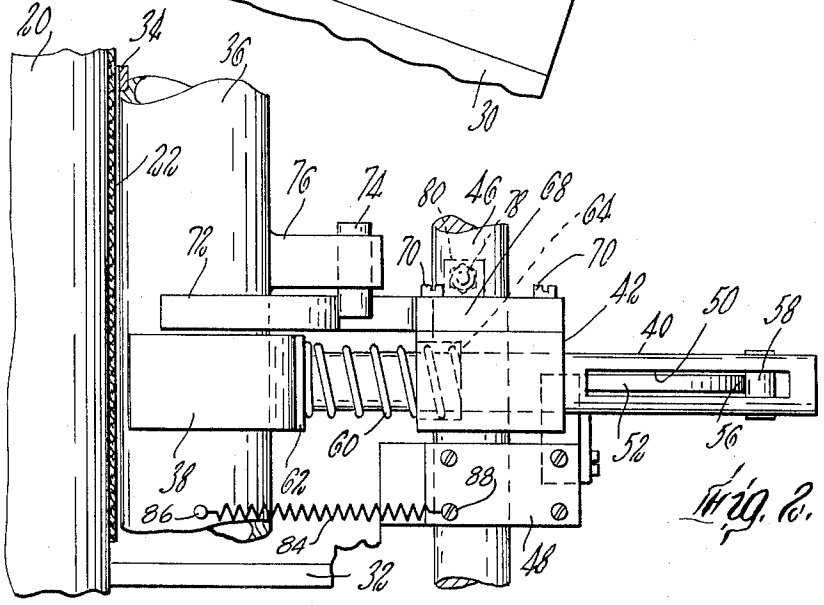


Fig. 2.

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TRAILING-BLADE-COATER INCLUDING ADJUSTABLE DRAG-BLADE

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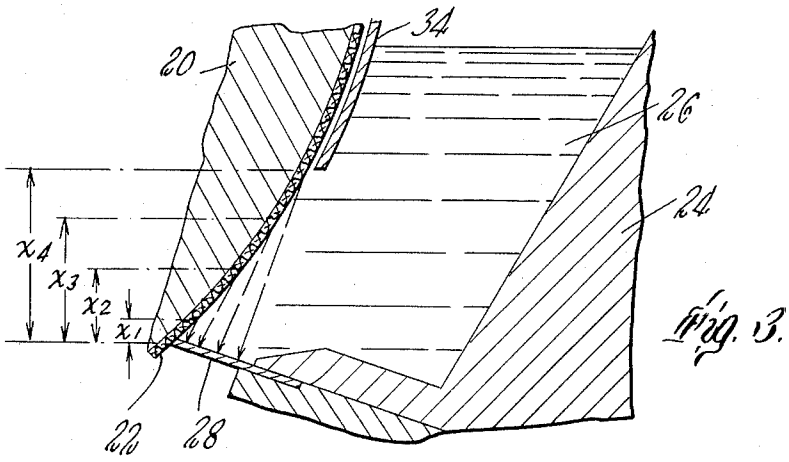


Fig. 3.

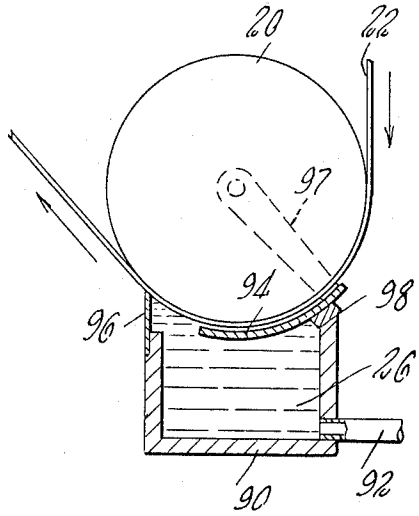


Fig. 4.

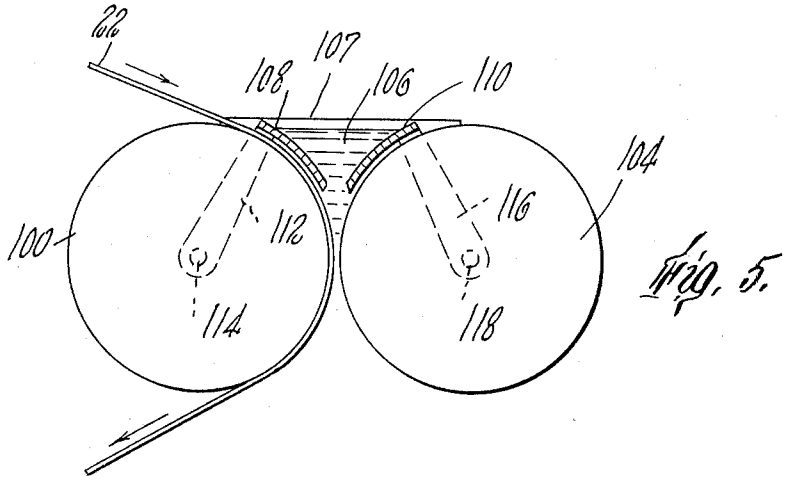


Fig. 5.

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TRAILING-BLADE-COATER INCLUDING ADJUSTABLE DRAG-BLADE

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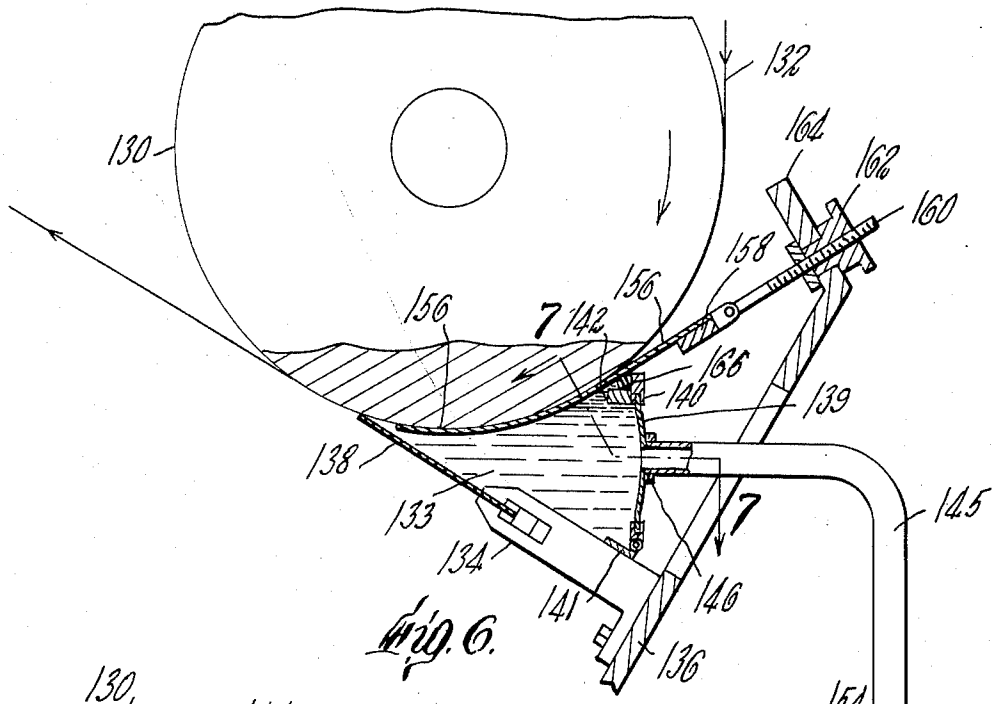


Fig. 6.

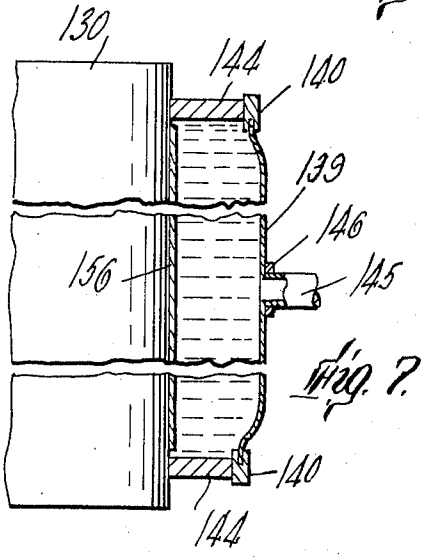
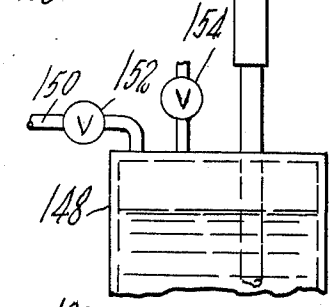


Fig. 7.



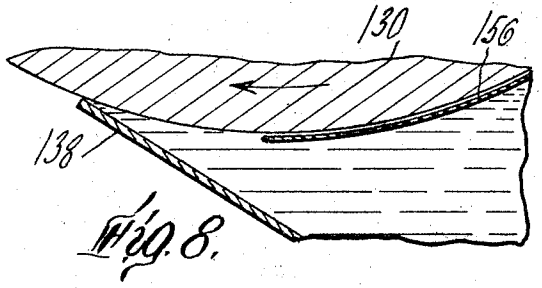


Fig. 8.

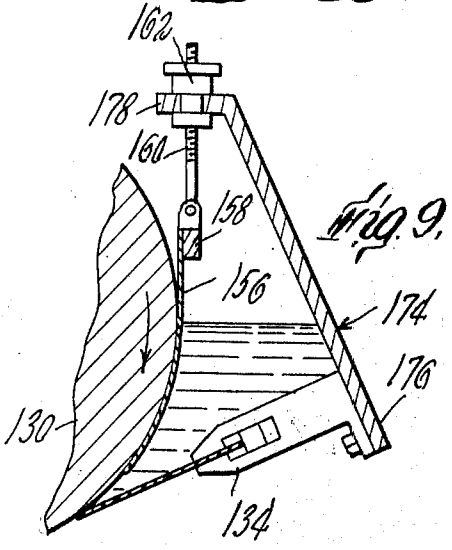


Fig. 9.

United States Patent Office 3,273,535 Patented Sept. 20, 1966

3,273,535

TRAILING-BLADE-COATER INCLUDING ADJUSTABLE DRAG-BLADE

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Filed Oct. 6, 1964, Ser. No. 408,716
10 Claims. (Cl. 118—410)

This application is a continuation-in-part of my prior application, United States Serial No. 206,378, filed June 29, 1962, for Liquid Applying Coaters and now abandoned.

The present invention relates to improvements in liquid applying coaters and more particularly to a drag blade for controlling the circulation of the liquid coating within the enclosure for said coating which is induced by the rapid passage of the web through the liquid and thereby to establish a better control of thickness and uniformity of said coating.

The invention is disclosed in a preferred form as embodied in a trailing blade type coater in which the web is passed downwardly around a backing roll past a liquid coating enclosure and doctor blade assembly which includes an enclosure for liquid coating material having an open face against said web and an enclosed rear face, and a doctor blade having a web engaging edge enclosing the bottom of said enclosure. In the operation of a coater of this general description, particularly when the web is driven at high speeds, a condition of turbulence tends to be set up within the enclosure which tends to produce an uneven distribution of the coating with consequent streaking and spotting of the coated web.

It is a principal object of the invention to provide a novel and improved device for controlling turbulence and any consequent tendency toward uneven distribution, streaking or spotting of the coating produced by the passage of the web through the reservoir under conditions of high-speed operation.

It is a further object of the invention to provide a reliable, readily adjustable means to accurately control the weight of the coating deposited on the traveling web.

With these and other objects in view as may hereinafter appear, a feature of the invention consists in the provision of a drag blade which is of a length to extend across the web and supported to extend from outside beneath the surface of the liquid coating, said drag blade being located adjacent the web at the point of entry of said web and drag blade into the liquid coating shielding the entering portion of the web from contact with the liquid coating and with the submerged inner edge of the drag blade spaced from the doctor blade so that that portion only of the traveling web beneath the surface of the liquid extending from said inner submerged edge of the drag blade to the leaving edge defined by the yieldable trailing edge of the doctor blade is in contact with the liquid coating.

The drag blade may be formed of a heavy gage steel which is pre-shaped to conform accurately to the curvature of the backing roll supported web, or may be formed of a flexible or pliable material to be suspended from above the reservoir adjacent the traveling web, so that the blade tends to be swayed and bent by the forces set up within the reservoir by the rapidly moving web to a position adjacent to and with a contour which is conformed generally to the curvature of the traveling web.

When the drag blade is thus located with the lower portion thereof projecting within the reservoir in a position closely adjacent the traveling web the liquid coating is engaged only with a portion of the traveling web below the liquid surface producing a smooth, even flow of the liquid without turbulence or other disturbance. The eddy

currents thus set up tend to bend and to mold the blade against the web, this tendency, however, being offset by an air suction set up between the traveling web and the blade which acts to support the blade in a narrowly spaced closely adjacent position with relation to the web.

Another feature of the invention consists in the provision of means for adjusting the position of the drag blade in an upward and downward direction to vary the spacing of the lower immersed edge of the drag blade from the doctor blade closing the lower or leaving side of the open face of the liquid coating enclosure.

The several features of the invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed which together with the advantages to be obtained thereby will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a detail sectional view in side elevation of a trailing blade type coater illustrating particularly the backing roll, the trailing doctor blade and coating pond assembly in combination with a drag blade mechanism, only so much of the machine having been shown as is believed necessary to show connection of the present invention therewith;

FIG. 2 is a plan view of substantially the parts shown in FIG. 1;

FIG. 3 is a view similar to FIG. 1 but with the drag blade in its raised position to illustrate the manner in which the increased loading and springing of the doctor blade will increase the thickness of the coating;

FIG. 4 illustrates a modified form of the invention in which the doctor blade and coating pond assembly are located directly beneath the backing roll and web;

FIG. 5 is a diagrammatic view illustrating an alternative form of the invention in which a second roller is provided in place of the doctor blade and coating pond assembly for applying a coating to the web;

FIG. 6 is a somewhat diagrammatic sectional view in side elevation similar to previous figures in which an extremely thin and flexible drag blade is employed in a pressurized coating pond assembly;

FIG. 7 is a detail plan section takes on a line 7—7 of FIG. 6;

FIG. 8 is a detail fragmentary view similar to FIG. 6, but on a larger scale showing the drag blade in a more open or withdrawn position of adjustment; and

FIG. 9 is a somewhat diagrammatic view similar to FIG. 7 in which a flexible drag blade is suspended within an open liquid coating container applied to a side of the backing roll and web traveling thereon.

Referring to FIG. 1 of the drawings, elements of a trailing blade type coater are shown including a backing roll **20** around which a traveling web **22** is drawn in a downward direction, and a coater head **24** which houses a liquid coating enclosure **26** and a doctor blade **28** mounted upon and closing the lower end of the enclosure **26**. The coater head **24** is adjustably secured in position on supporting arms **30** which are attached to the two ends of the coater head. The two ends of the enclosure **26** are closed by means of dikes which may be of the general type indicated at **32** in FIG. 2. In the present construction there is also provided a drag blade **34** which extends across the width of the web between the dikes **32** and is curved as shown in cross section to conform substantially with the curvature of the web passing around the backing roll **20**. The drag blade **34** is secured at its upper edge to a tubular member **36** which extends across the width of the backing roll **20**. By way of contrast with the disclosure of FIGS. 6 and 7, the blade **34** is assumed to be of sufficient thickness to be self-supporting so that

the desired curvature is maintained independently of the hydraulic forces set up in the bath by the rapidly moving web.

The tubular member **36** is supported at each end by two identical supporting structures one of which is shown in FIGS. 1 and 2. Each of the two supporting structures referred to comprises an open ring bearing **38** for the tubular member **36**, said ring bearing **38** being formed on the projecting end of a plunger **40** which is slidably mounted in a block **42** rotatably supported on a cylindrical bar **46** which is secured to and forms an integral part of the color pond **24** and doctor blade **28** assembly. As best shown in FIGS. 1 and 2 the rod **46** is rigidly clamped adjacent each end in a split clamp **48** forming part of the color pond **24** assembly.

The supporting structures for the tubular member **36** and drag blade **34** are constructed and arranged for angular adjustment about the rod **46** to effect an up and down adjustment of the drag blade to control the width of the traveling web area exposed to the coating material in the color pond. A rotational adjustment of said supporting structure is employed to effect a corresponding forward and back adjustment of the plungers **40** and drag blade **34**, and also to maintain the contoured inner surface of the drag blade in narrowly spaced relation closely adjacent the traveling web.

The plunger **40** is provided toward its rear end with a vertical slot **50** which receives a relatively fixed vertically disposed cam plate **52**, the lower end of which is formed with a lateral extension **54** bolted to the rear face of the splint clamp **48**. The rear edge of the cam plate **52** is formed with a cam surface **56** which is adapted for engagement with a follower roll **58** which extends across the rear end of the slot **50** in the plunger **40**. The cam plate **52** extending through the slot **50** acts to support the assembly including plunger **40** and block **42** against axial movement on the rod **46**. The cam surface **56** engaging roll **58** determines the forward and back position of the plunger, which is biased in a forward direction by means of a spring **60** coiled about the plunger between a collar **62** on the plunger and a recessed shoulder **64** in the block **42**. The contour of the cam **56** is such that rotational movement of the block **42** and supported plunger **40** about the axis of shaft **46** will effect a corresponding forward or back movement of the shaft **40** which causes the tubular member **46** and drag blade **34** to be maintained for all angular adjustments of the supporting assembly closely adjacent the surface of the web **22** and backing roll **20**. The up and down adjustment of the drag blade assembly above described is accompanied by a corresponding angular adjustment of the shaft **36** and drag blade **34** so that the lower edge of the drag blade is also maintained in its proper position closely adjacent the traveling web. To this end there is secured to the block **42** a plate **68** which is secured by screws **70** to one side of the block **42** and which is provided with a forwardly and upwardly extending arm **72** providing a cam surface which is engaged by a roller **74** mounted on a short rearwardly extending post **76** secured to the tubular member **36**.

Each block **42** together with the associated plunger **40** and cam plate **68** is rigidly held in adjusted position on the cylindrical bar **46** by means of a set screw **78** screw threaded through a lug **80** in the cam plate **68** for engagement with one of a series of indents **82** in the surface of the cylindrical bar **46**.

Adjustment of the vertical position of the drag blade **34** is effected by varying the angular position of the blocks **42** on the cylindrical bar **46** in the following manner:

Assuming that the blocks **42** are adjusted in a clockwise direction from the full-line position shown in FIG. 1, the movement of the rollers **58** on their cams **56** will permit a forward movementof the two plungers **40** under the influence of springs **60** to maintain the tubular member **36** upper edge of the drag blade **34** in the desired position of adjustment with respect to the traveling web. At the same time the movement of the post **76** and roll **74** with relation to the cam extension **72** will control the angular position of the tubular member **36** and drag blade **34** to maintain the lower edge of the drag blade in the desired spaced relation to the traveling web and blade. The roller **74** is held against its cam **72** by any convenient means as, for example, a spring **84** tensioned between a pin **86** on the upper side of the tubular member **36** and a pin **88** on the split clamp **48**. If no such biasing spring is provided, the forces generated by the rapidly moving web which include air suction between the web and the inner surface of the drag blade, and the eddy currents induced in the liquid within the reservoir may be expected to maintain the drag blade in approximately the desired position.

The drag blade **34**, located in close proximity to the rapidly moving web, has the affect of shielding the web from the coating material in the enclosure over an area which extends from the level at which the web passes below the surface level of the liquid coating to the level of the emergence of the web from behind the bottom edge of the drag blade **34**. With this arrangement a pull is exerted upon the liquid coating **22** only during the short extent of travel of the web from the line of its emergence from beneath the drag blade **34** to the line of engagement with the doctor blade at the bottom tip of the enclosure. The liquid is thus caused to circulate in a manner which completely avoids the turbulence, splattering, and uneven pulling action which results when the rapidly moving web is brought directly into contact with the surface of the liquid coating.

An upward or downward adjustment in the position of the drag blade **34** has the effect of correspondingly varying the drag length during which a pull is exerted on the liquid coating by the traveling web. A plurality of adjusted positions of the drag blade are shown in FIG. 3, said different positions of the drag blade **34** being indicated by the characters x_1 to x_4 inclusive. It will be noted that with each upward adjustment of the drag blade there is a tendency for a greater amount of the liquid material drawn down to be forced under pressure against the top face of the doctor blade **28**. As the weight of the liquid material being forced against the blade **28** increases, the blade is caused to bend outwardly thus increasing the thicknesses of the resulting coat.

An alternative embodiment of the invention is shown in FIG. 4 of the drawings in which the coater head designated at **90** is engaged against that portion of the web **22** which is directly beneath the backing roll **20**. The liquid coating supplied to the enclosure through inlet **92** in this case is maintained under some pressure which insures an intimate contact of the coating with the traveling web between the tip edge of the drag blade **94** and the edge of the doctor blade **96**. In this form of the apparatus the drag blade **94** extends from without the within the area occupied by the liquid coating enclosure, and is supported on arms **97** pivoted upon and extending radially from the axis of the roll **20**. A seal **98** interposed between the underside of the drag blade and the entering edge of the enclosure prevents leakage of the coating at this point. As shown in FIG. 4 the surface of the liquid and the entering edge of the enclosure **90** coincide. The traveling web exerts a drag upon the liquid coating which extends from the terminal edge of the drag blade **94** to the point of engagement with doctor blade **96**. The liquid in the enclosure is thus put in motion traveling in a circular path which is substantially free from turbulence so that the liquid is forced evenly and under constant pressure against the face of the doctor blade. In this form of the device, the surface of the liquid and the entering edge of the enclosure coincide. The adjustment of the forward and back position of the drag blade **94** about the axis of rotation of the backing roll **20** is controlled by angular adjusting of the supporting arms **97**

about the rotational axis of the backing roll **20**, and has the effect of correspondingly varying the weight of the liquid coating forced against the inner face of the doctor blade and consequent thickness of the coating applied to the web.

Still another application of the drag blade in accordance with the present invention is shown in FIG. 5, in which there is shown a backing roll **100** which provides support for the traveling web **22**. For applying a coating to the web **22** there is provided a coating roll **104** which is mounted in parallel relation to the backing roll **100** in a position to provide a liquid coating applying nip to the web **22**. A pool of liquid coating **106** is formed above and beneath the two rolls. FIG. 5 is intended only as a diagrammatic disclosure of the modification. It will be understood that dikes of ordinary description such as that shown at **32** in FIG. 2, but contoured to fit between the rolls **100** and **104** as suggested at **107** in FIG. 5 may be employed to close in the ends of the pool. In this form of the apparatus two drag blades **108**, **110** are provided, the drag blade **108** being supported on arms **112** pivoted on axis **114** of roll **100** to be located in close proximity to the traveling web **22** and backing roll **100** in such a position that it extends from above the level of the liquid pool **106** to beneath the surface thereof. The drag blade **110** is mounted to extend across the width of the coating roll **104** in close proximity thereto and similarly extends downwardly into the liquid coating from a point substantially above the surface thereof. The drag blade **110** is mounted on arms **116** carried on the axis **118** for the coating roll **104**. In this form of the device the thickness of the coating applied to the traveling web will depend on the up and down adjustment of each of the two drag blades **108**, **110**.

FIGS. 6, 7 and 8 illustrate a further embodiment of the invention in which the drag blade is a flexible element, here shown as a very thin gage steel blade, although the blade may consist of a non self-supporting limp or pliable material such as sheet rubber or the like. In FIGS. 6–8 the backing roll is designated at **130** and the traveling web at **132**. A liquid coating container **133** is provided which consists of doctor blade holder **134** secured to a transverse frame member **136**, and a doctor blade **138** supported in the holder for trailing engagement with the underside of the backing roll **130** and traveling web **132**. The rear side of the liquid coating container is closed by a preferably resilient member **139** supported in a frame **140** attached at its lower edge by a hinge **141** to the holder **134**, and along its upper edge secured to a transverse frame member **142** which is mounted closely adjacent the backing roll **130** and traveling web **132**. The ends of the liquid coating container are closed by dikes **144** shown in FIG. 7. Liquid coating is supplied to the liquid coating container **133** above described by means of a pipe **145** connected at one end to an inlet **146** for the container and at its other end extending downwardly within a liquid coating storage tank **148**. In the illustration shown the liquid coating is supplied to the container **133** under pressure, the tank **148** being pressurized for this purpose by compressed air supplied through an inlet pipe **150** from a supply source, not shown. Air pressure is controlled by a valve **152** in the air inlet line **150**, and further by a safety valve **154** fitted into the top of the tank.

In this form of applicant's invention a very flexible thin gage steel drag blade **156** is employed which is introduced through a narrow opening provided between the back side of the container **133** and the traveling web **132**. The drag blade **156** is supported along its upper edge by a transverse holder **158** provided at intervals along its length with screw bolts **160** screw threaded to cooperating nuts **162** rotatably fitted in apertures provided in an offset upper edge portion **164** of the transverse support **136**. To prevent loss of the liquid coating through the opening at the upper edge of the transverse frame member **142**, a rubber bead or similar flexible sealing element **166** is provided, fitted into an angle provided between the transverse frame member **142** and the frame **140** for engagement against the outer face of the drag blade **156**.

The direct engagement of the liquid coating with the exposed portion of the traveling web **132** between the lower edge of the drag blade **156** and the point of engagement of the web with the doctor blade **138** gives rise to viscous drag forces and eddy currents which cause the flexible drag blade **156** to be pressed toward the back roll and web so that the contour of the inner face thereof tends to be conformed substantially to the path of the traveling web. A depth adjustment of the drag blade into the container to vary the width of web exposed to the liquid coating between the lower edge of the drag blade and the doctor blade is effected by adjustment of the nuts **162**. The withdrawal of the drag blade **156** to the position of FIG. 8, for example, by substantially increasing the area of the traveling belt directly in contact with the coating fluid, will increase the downward flow of fluid and correspondingly increase the deflection of the doctor blade **138**. Further control of coat thickness is effected by variation in the air pressure at the valve **152** which thus increases or decreases, as the case may be, the fluid pressure within the liquid coating container **133**, and correspondingly the mass of the liquid coating which is forced by the doctor blade **138**. With these adjustments, required adjustments and corrections in the flow and thickness of coating deposited on the web can be made readily during continued operation of the coater.

FIG. 9 illustrates a further modification of the invention in which the highly flexible drag blade **156**, secured along its upper edge to the transverse bar holder **158**, is supported from without to extend within a body of liquid coating contained in an open container **174** located at one side of the backing roll **130** and traveling web **132**. The container **174** comprises the doctor blade holder **134** and doctor blade **138** secured to a transverse frame member **176**, and end dikes which may be similar to those shown at **144** in FIG. 7. The drag blade **156** and holder **158** are suspended from a bent over edge **178** of the transverse frame member **176** by means of screw bolts **160**, pivotally connected with the bar holder **158** of the drag blade **156**, and screw threaded toward their upper ends through rotatable nuts **162** rotatably supported in apertures in the bent over edge **178**.

The highly flexible drag blade **156**, suspended as shown in FIG. 9 and also as shown in FIGS. 6–8, extends from outside beneath the surface of the liquid in the liquid coating container **133**, is disposed in narrowly spaced parallel relation to and closely adjacent the traveling web across the width of the opening in the container, and is acted upon in such a manner by the traveling web and liquid currents set up in the container that the contour of the face of the drag blade is conformed substantially to the path of the back roll supported web. The rapid movement of the web **132** causes an air draft to be introduced between the web and the drag blade **156** producing an air film, which, although it may be only a few millionths of an inch in thickness, will cushion the drag blade slightly away from the web and will also prevent liquid from seeping under the bottom edge of the blade.

It will be understood that the flexible drag blade **156** may be substituted for the heavier gage drag blade **34** in the liquid reservoir and doctor blade assembly of FIG. 1, and that said flexible blade when so installed will operate in a manner similar to the drag blade **34** to control turbulence and the thickness and quality of the coating produced.

It will be understood further that the invention in its broader aspects is not limited to the specific embodiments shown and that modifications may be made within the spirit and scope of the appended claims in the precise composition, shape and surface texture of the drag blade

supported adjacent the traveling web at the point of entry into the body of liquid coating to shield said entering portion of the web, so that only a submerged portion of the traveling web extending from the lower edge of the drag blade to the leaving edge of the container defined by the yieldable trailing edge of the doctor blade is in contact with the liquid coating.

The invention having been described what is claimed is:

1. In a coater having a backing roll around which a traveling web to be coated is drawn, a liquid coating reservoir and doctor blade assembly which comprises a liquid coating enclosure having an open face disposed against said web and supporting backing roll; a trailing type doctor blade forming a base portion of said enclosure and having the trailing edge thereof yieldably supported with relation to said traveling web in position closing the leaving edge of said open face; a drag blade disposed in narrowly spaced relation to said traveling web across the width of the web and having the face thereof conformed generally to the web and backing roll over which the web passes; said drag blade extending from above the top face of said liquid coating material and terminating in an inner submerged edge spaced from said doctor blade thus forming a wall of said enclosure and generally preventing contact of said material with the traveling web portion contiguous to said drag blade so that substantially that portion only of the traveling web extending from said inner submerged edge of the drag blade to the leaving edge defined by said doctor blade is in contact with said liquid coating; and adjustable supporting means on which said drag blade is shiftable relatively to said backing roll to vary the width of the space between the inner submerged edge of the drag blade and the doctor blade and thereby the thickness of coating material driven past the yieldable trailing edge of said doctor blade.

2. In a coater having a backing roll around which a web to be coated is drawn, the combination of a liquid coating reservoir and doctor blade assembly according to claim 1 in which the drag blade is a rigidly formed self-supporting element having a face adjacent said web contoured substantially to the curvature of the traveling web.

3. In a coater having a backing roll around which a web to be coated is drawn, the combination of a liquid coating reservoir and doctor blade assembly according to claim 1 in which the drag blade is a flexible and pliable element which tends to be conformed to the curved traveling web by forces set in motion by the traveling web.

4. In a coater having a backing roll around which a web to be coated is drawn, the combination of a liquid coating reservoir and doctor blade assembly according to claim 3 in which the drag blade is a thin flexible metallic element which tends to be conformed to the curved traveling web by forces set in motion by the traveling web.

5. For use in a coater having a backing roll around which a traveling web to be coated is drawn, and a liquid coating reservoir and applicator assembly which comprises, in combination, a liquid coating enclosure having an open face disposed against said web and supporting backing roll; and a liquid coating applicator disposed upon the leaving edge of said liquid coater; a drag blade disposed in narrowly spaced parallel relation to said traveling web of a length to extend across said web, and curved to substantially the radius of curvature of said web, said blade entering the surface of the liquid coating from the entering side of said enclosure and terminating beneath the surface of said liquid in a lower edge spaced from said applicator thus forming a wall of said enclosure and generally preventing contact of said material with the traveling web portion contiguous to said drag blade; and a support assembly for said drag blade comprising a plurality of supporting structures having a common rotational axis fixed with relation to said enclosure and parallel to the axis of said backing roll, each said structure comprising a plunger pivotally connected at its outer end with said drag blade, a sleeve support block rotatably adjustable on said axis providing a sleeve support for said plunger, a cam follower supported on said plunger in combination with a cam fixed with relation to said enclosure, said cam and follower being conformed for any angular adjustment of said sleeve support to effect a corresponding movement of the plunger axially as it is carried through said angular adjustment and tending to thereby impart to the drag blade a resultant compound movement; and cam and follower connections between said plunger and drag blade conformed for any said combined axial pivotal movement of said plunger to maintain constant said closely spaced parallel relationship of the blade to the peripheral surface of the backing roll, the drag blade thus having a total movement which is arcuate with respect to the traveling web contiguous therewith and the backing rolls.

6. In a coater having a backing roll around which a web to be coated is drawn, and a drag blade according to claim 1, the combination of having a liquid reservoir and doctor blade assembly pivotal supporting means coaxial with said backing roll axis on which said drag blade is shiftable arcuately about the backing roll axis to vary the width of said space and thereby the thickness of coating material driven past the trailing edge of said doctor blade.

7. In a liquid material applying coater having a backing roll around which a web to be coated is drawn, and a liquid coating reservoir and applicator assembly which comprises a liquid coating enclosure having as one side of said enclosure the downwardly drawn web and supporting backing roll according to claim 1 the combination, in which the opposite side of said enclosure comprises an opposed liquid applying roll providing a liquid coating applying nip against a downwardly moving portion of the backing roll supported web, and a second drag blade similarly disposed in narrowly spaced relation to and closely adjacent said liquid applying roll extending from above the top face of and terminating beneath the surface of said liquid coating.

8. In a coater having a backing roll around which a web to be coated is drawn according to claim 1, the combination of dikes closing the two ends of said open face, and a resilient sealing element closing the web receiving edge of said open face, the drag blade is a flexible drag blade disposed across the width of said web extending between said resilient sealing element and web from outside the body of said liquid and terminating beneath the surface of the liquid with the submerged portion of said drag blade substantially conformed to the curvature of the traveling web and backing roll and with the submerged edge of said drag blade spaced from the doctor blade so that that portion only of the web traveling across said open face is in contact with said liquid coating, and a support to which the drag blade is attached externally of said enclosure.

9. In a coater having a backing roll around which a web to be coated is drawn, the combination of a liquid coating reservoir and doctor blade assembly according to claim 8 in which means are provided for supplying liquid coating under pressure to said enclosure.

10. In a coater having a backing roll around which a web to be coated is drawn, the combination of a liquid coating reservoir and doctor blade assembly according to claim 9, in which a portion of said enclosure is formed of resilient material in order to minimize pressure variations within said enclosure.

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2,855,895	10/1958	Burns et al.	118—407
3,018,757	1/1962	Loppnow	118—262
3,094,924	6/1963	Stack	101—364 X
3,115,433	12/1963	Eolkin et al.	118—7 X

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