Jan. 16, 1968 L. M. HILL 3,363,603

FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

Filed March 12, 1965 6 Sheets-Sheet 1

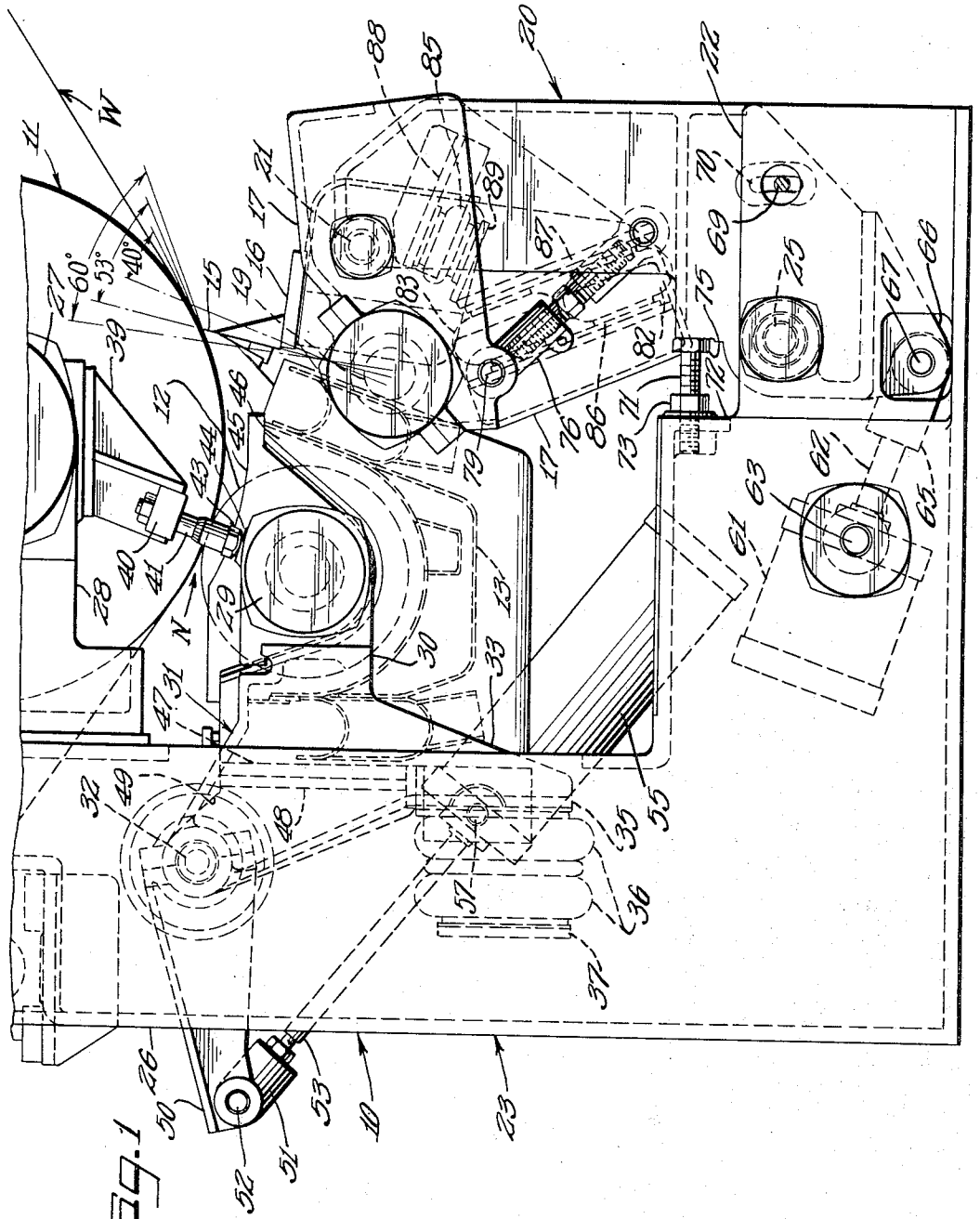

FIG. 1

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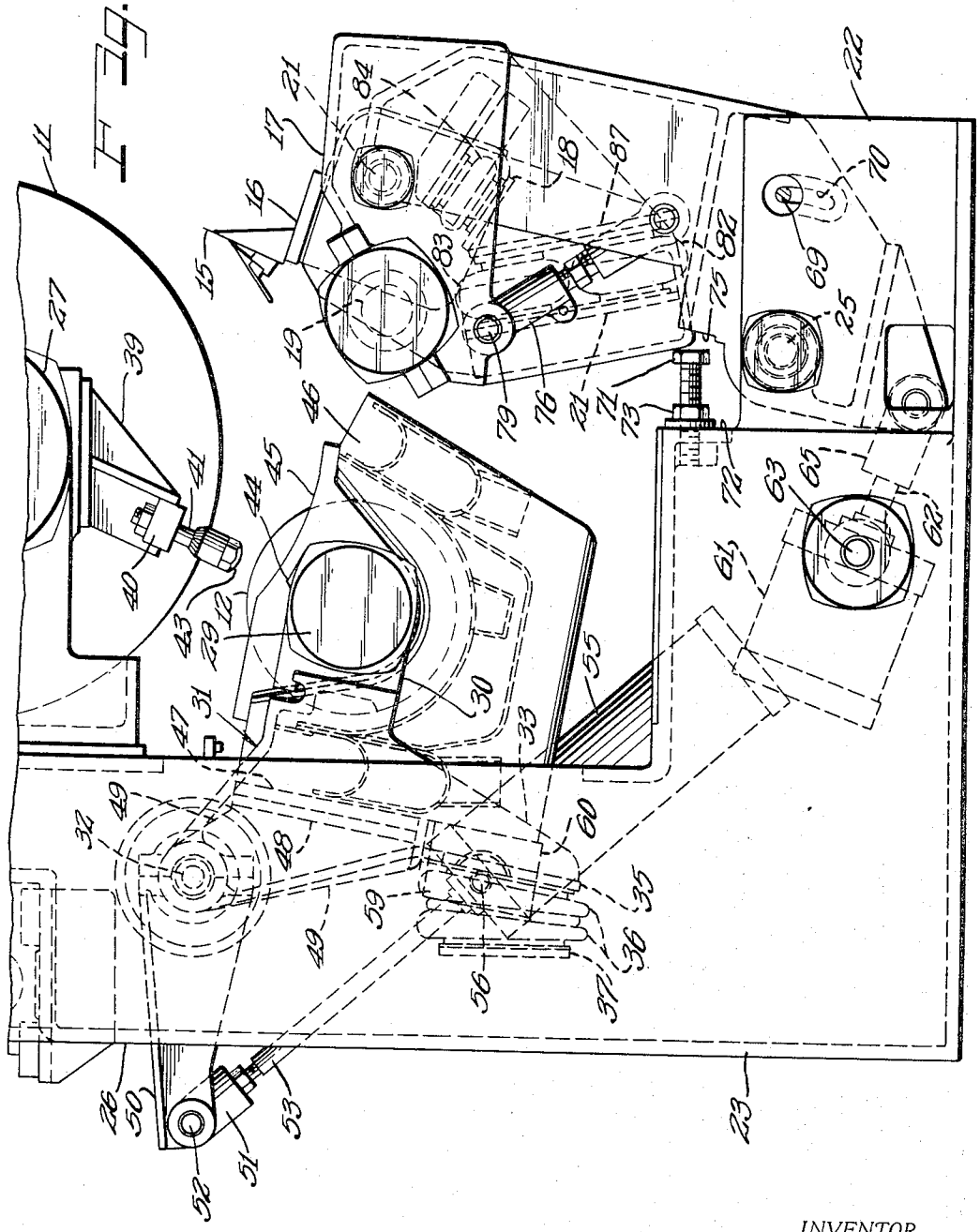
FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

Filed March 12, 1965 6 Sheets-Sheet 2

Fig. 2



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FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

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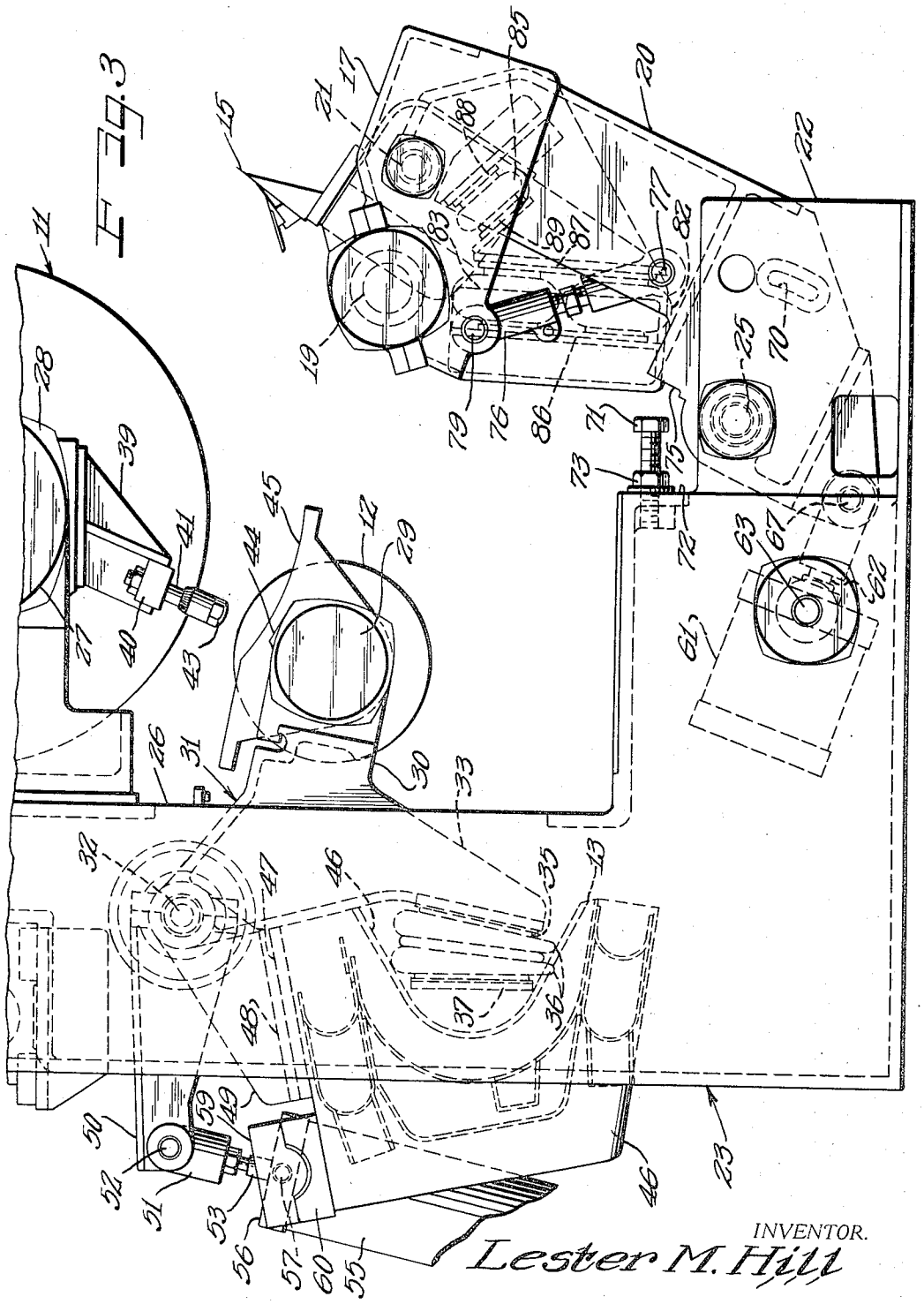
Fig. 3



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Jan. 16, 1968 L. M. HILL 3,363,603

FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

Filed March 12, 1965 6 Sheets-Sheet 4

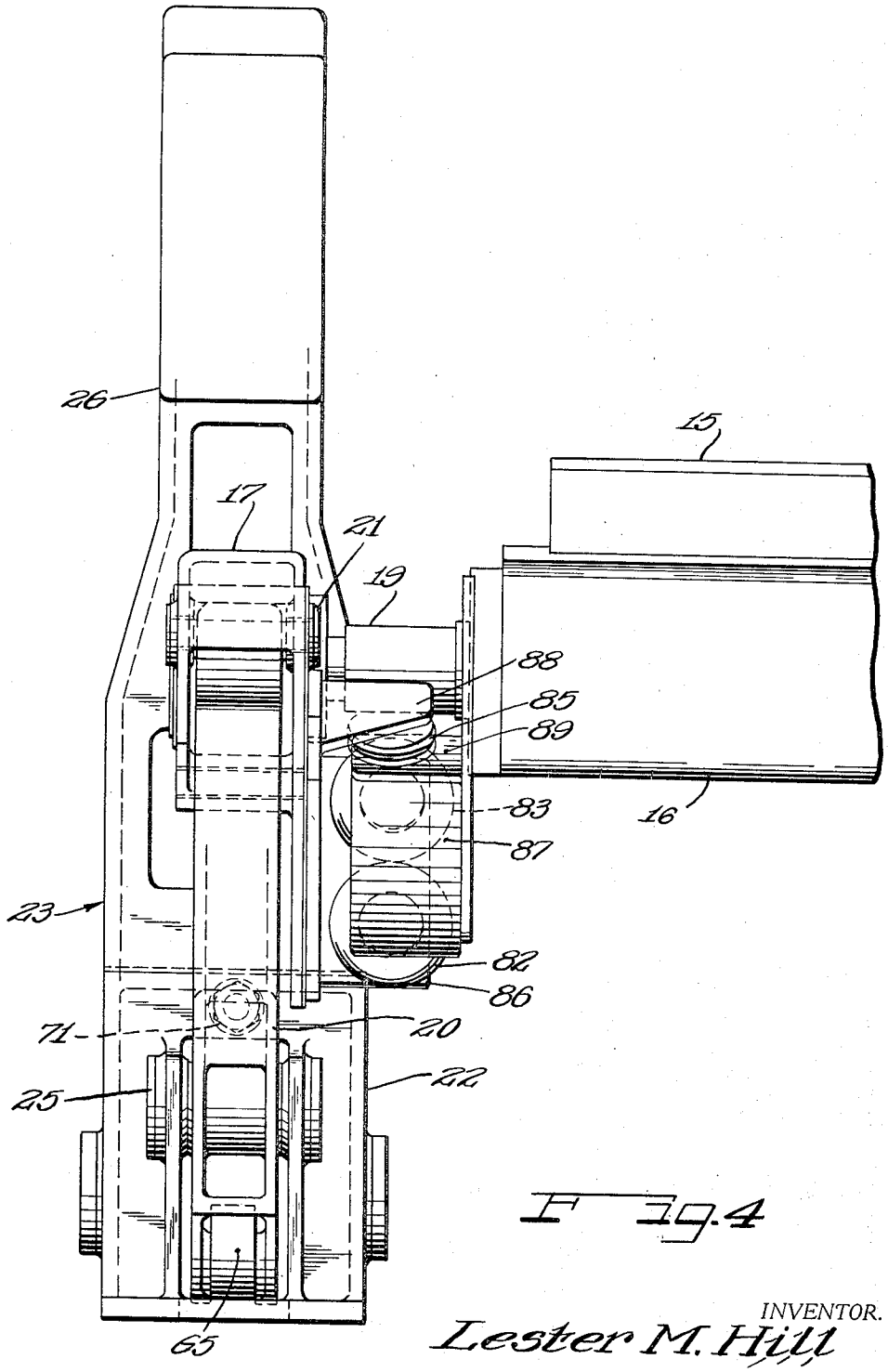

Fig. 4

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FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

Filed March 12, 1965 6 Sheets-Sheet 5

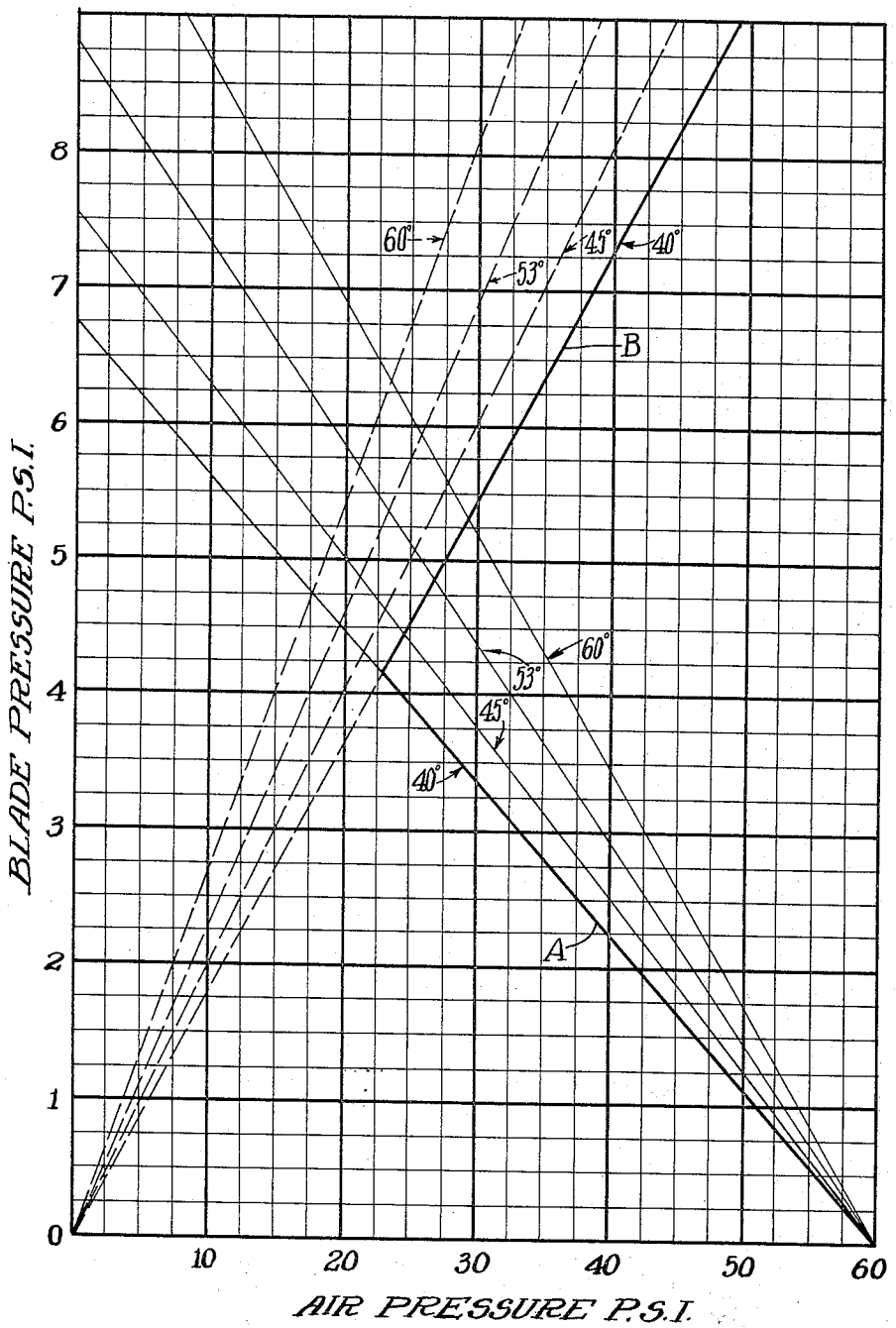

Fig. 5

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FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

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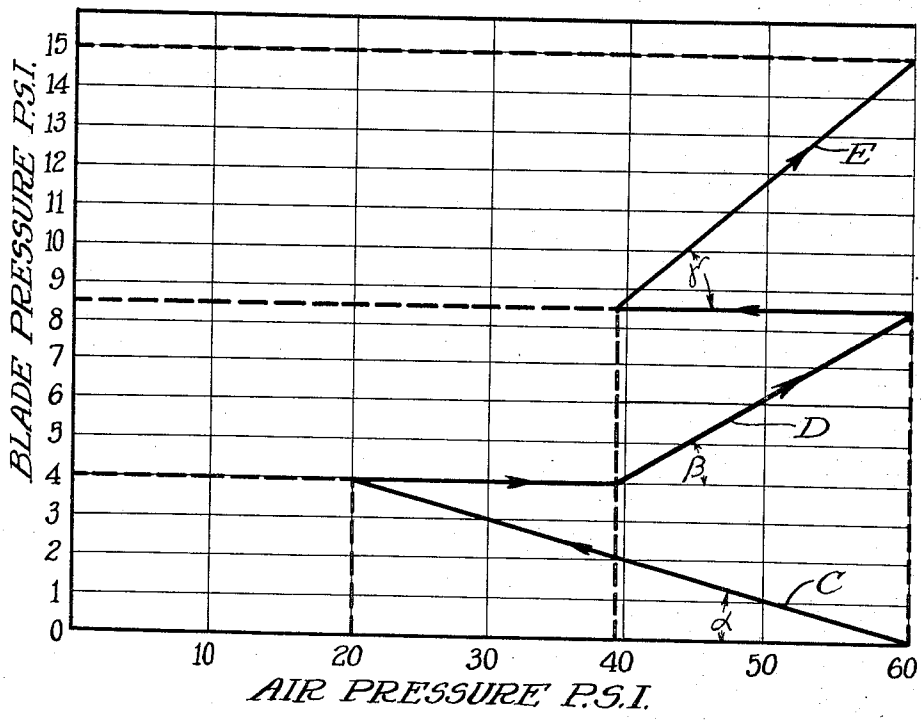

Fig. 6

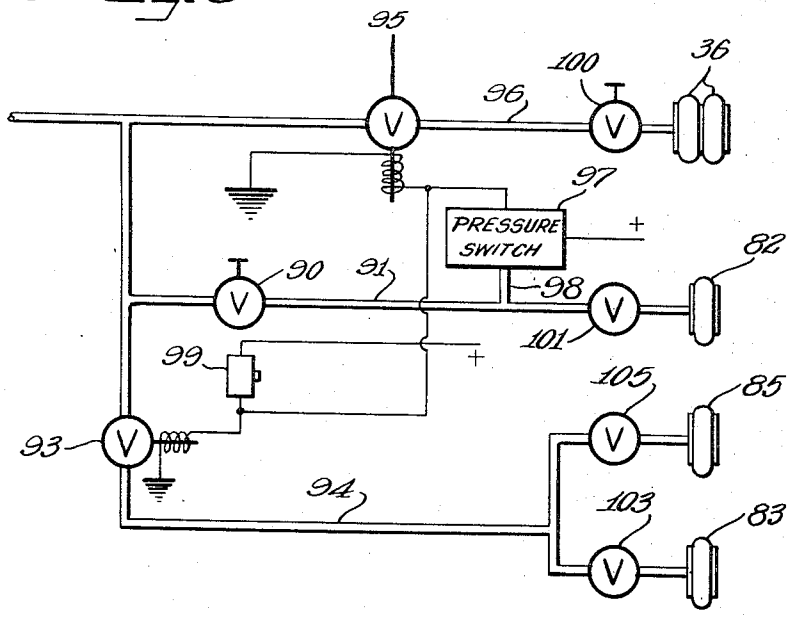

Fig. 7

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United States Patent Office 3,363,603 Patented Jan. 16, 1968

3,363,603

FLOODED NIP COATER DOCTOR BLADE AND LOADER THEREFOR

Lester M. Hill, Beloit, Wis., assignor to Beloit Corporation, Beloit, Wis., a corporation of Wisconsin

Filed Mar. 12, 1965, Ser. No. 439,370
11 Claims. (Cl. 118—126)

ABSTRACT OF THE DISCLOSURE

Low pressure loading means for the doctor back and blade of a flooded nip coater. The doctor back is pivoted between two support arms. The loading means is in the form of opposed independently operable fluid pressure operated loading devices connected between opposite sides of the support and a doctor back. One loading device exerts pressure on the doctor back in a load-relieving direction. The other loading device exerts pressure on the doctor back in a load-applying direction. The loading device exerting pressure in a load-relieving direction is a fluid pressure diaphragm interposed between one side of the support and the doctor back while the loading means exerting pressure on the doctor blade in a load-applying direction is in the form of two independently operable fluid pressure diaphragms interposed between the opposite side of the support and the doctor back.

This invention relates to improvements in devices for coating traveling webs of paper and the like and more particularly relates to improved loading means for the doctor back and doctor blade for the coater.

The present invention has as its principal objects to provide an improved form of flooded nip coater arranged with a view toward simplicity in threading the paper web through the coater and utmost efficiency in coating and doctoring.

A still further object of the invention is to provide a simple and improved form of loading mechanism for the doctor blade of a flooded nip coater, providing accurate low blade pressures by relatively high loading air pressures.

A still further object of the invention is to provide an improved form of loading mechanism for loading the doctor blade of a flooded nip coater at a controlled relatively low pressure.

A still further object of the invention is to improve upon the loading mechanisms for doctor blades heretofore used for smoothing the coating applied to a web, in which the force applied to the blade holder may be accurately regulated to provide a required low blade pressure, for controlling the coating weight applied to the web.

Still another object of the invention is to provide an improved form of flooded nip coater using a doctor blade at the outgoing side of the applicator roll, for controlling the coating weight, in which an accurate control of the blade pressure is obtained by the use of opposing high pressure fluid pressure operated loading devices enabling the blade pressure to be easily changed without adversely affecting sensitivity of control.

A still further object of the invention is to provide a novel and improved form of loading device, loading the doctor blade to a required pressure, in which the loading device is capable of operating at a higher and more easily controlled pressure than the desired pressure of the blade, to attain a more accurtae control of the blade pressures than has heretofore been possible.

A still further object of the invention is to provide a support and fluid pressure operated loading mechanism

for a trailing doctor blade of a coating mechanism, enabling the blade angle to be readily changed, and eliminating all torsional forces and stresses which tend to twist or cause uneven blade pressures.

Still another object of the invention is to provide a simplified form of loading mechanism for the trailing doctor blade of a flooded nip coater in which a single relatively high pressure fluid pressure operated diaphragm acts on the doctor back and blade, to relieve the pressure therefrom, and in which two independently operable fluid diaphragms oppose the high pressure fluid diaphragm, and supply pressure to load the doctor blade at a wide range of selected relatively low pressures. All obtained by the high pressure fluid operated loading diaphragms.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a fragmentary view in side elevation of a flooded nip coater constructed in accordance with the principles of the present invention with the applicator roll and doctor blade in their operative coating and doctoring positions;

FIGURE 2 is a fragmentary side elevational view somewhat similar to FIGURE 1, but showing the applicator roll and doctor blade in their threading positions;

FIGURE 3 is a fragmentary side elevational view similar to FIGURES 1 and 2, but showing the coating bath pan and doctor blade in their retracted clean up positions;

FIGURE 4 is a fragmentary end view of the coater shown in FIGURES 1 through 3, looking at the coater toward the doctor blade, with the coating pan and applicator roll removed;

FIGURE 5 is a graph illustrating one method of loading the doctor blade;

FIGURE 6 is a graph illustrating an alternative method of loading the doctor blade; and

FIGURE 7 is a fluid pressure diagram illustrating a form of valving arrangement which may be used for loading the loading air diaphragms for the applicator roll and doctor blade.

In the embodiment of the invention illustrated in the drawings, **10** generally designates a coating device, which comprises a back-up roll or drum **11**, wrapped by a traveling sheet or web W, and an applicator roll **12** picking up coating material from a coating bath pan **13**, and applying it to the sheet W wrapped beneath the back-up roll **11**. The coating device also includes a doctor blade **15** mounted on and extending along a doctor back **16**, trunnioned between a pair of laterally spaced support arms **17**, **17** on trunnion pins **19**. The support arms **17**, **17** are in turn pivotally mounted on a frame member **20** on laterally spaced coaxial pivot pins **21**. The frame member **20** extends across the machine upwardly along the inner sides of laterally spaced feet **22** of a coater main frame **23**. Pivot pins **25** pivotally mount the frame member **20** to the feet **22** for adjustable movement about the axes of the pivot pins **25**, in the manner which will hereinafter more clearly appear as this specification proceeds.

The back up roll **11**, applicator roll **12** and coating bath pan **13** are mounted between parallel spaced posts **26** of the main frame **23**. The back up roll **11** is journalled at its ends in bearing supports **27** mounted on support structure **28** extending forwardly of the post **26** in generally parallel relation with respect to the feet **22** of the main frame **23**. The back-up roll may have a resilient face and may be driven by a suitable drive means, such as an electric motor (not shown), in a conventional manner,

to attain a predetermined peripheral speed of the back-up roll in accordance with the required speed of travel of the web W.

The applicator roll 12 may be driven from a suitable motor (not shown), and is longer than the width of the web on the back-up roll 11, and extends substantial distances along the exposed edges of the surface or periphery of the back-up roll 11. The applicator roll 12 may be rotated in the direction of web travel, or may be rotated in an opposite direction, for certain coating applications. A nip N formed between the back-up roll 11 and the applicator roll 12 may be such as to merely permit contact between the web W and the applicator roll 12, to the extent necessary to apply the coating material at the nip N. The weight of coating applied varies with the hydrodynamic pressure in the nip defined by the back-up roll 11 and the applicator roll 12, and increases as the coating viscosity, coating speed or quantity supplied to the nip increases.

The extent of contact between the applicator roll 12 and the web W and their relative speeds may be correlated so that the web W removes coating material from the surface of the applicator roll 12 slightly more rapidly than the coating material is brought up to the nip N, with the result that the coating material is spread much more thinly on the web W than on the surface of the applicator roll 12. The appliactor roll 12 is partially immersed in a bath of coating material contained in the pan 13, and the amount of coating material that is filmed onto the up running side of the applicator roll 12 may be controlled by the level of coating material in the pan 13, which level may be controlled in a conventional manner.

The applicator roll 12 is journalled at its opposite ends in bearing supports 29 mounted on arms 30 of bell cranks 31. The bell cranks 31 are each mounted on a pivot shaft 32 extending transversely of the associated post 26 and suitably mounted thereon. Each bell crank 31 has a depending lever arm 33 depending from the pivot 32 and the lever arm 30 and having a rearwardly facing bearing pad 35 engaged by double diaphragms 36 and known to the trade as a double air ride. The opposite end of the diaphragms or air ride 36 from the bearing pad 35 engages a bearing pad 37 mounted on the main frame 23 and extending transversely thereof.

The double diaphragms 36 have a relatively large combined stroke, and are capable of swinging the applicator roll 12 towards the back-up roll 11 from the web threading position shown in FIGURE 2 to the coating position shown in FIGURE 1.

Each bearing housing 27 has a bracket 39 depending therefrom having a lug 40 extending outwardly therefrom forming a support for a stud 41, forming a mounting for a micro stop 43. The micro stops 43 are of a conventional construction, commonly used in paper machinery and particularly in coaters, so need not be shown or described in detail herein. The micro stops 43 are engaged by upwardly facing bearing surfaces 44 on the bearing housings 29, and extending perpendicular to the longitudinal axes of the studs 41. The micro-stops 43 space the applicator roll 12 from the web the required distance and permit a fineness of adjustment of the nip N, and thereby may vary the spacing between the web and the applicator roll and determine the amount of coating applied to the web at the nip.

The bearing supports 29 have end dams 45 suitably mounted thereon and having sealing engagement with opposite end walls 46 of the coating bath pan 13. The end dams 45 may be sealed around the journal and provide removable end dams for the coating bath pan 13, sealing the pan when in its operative position shown in FIGURE 1 and its threading position shown in FIGURE 2, and accommodating the pan to be moved out of engagement with said end dams when moved to the cleaning position shown in FIGURE 3.

The structure of the coating bath pan 13 is conventional and similar to that shown and described in my prior application Ser. No. 316,293, filed Oct. 15, 1963, and no part of the present invention, so not herein shown or described in detail.

As shown in FIGURE 1, the opposite end walls 46 of the coating bath pan 13 have rear bearing plates 47 abutted by and secured to mounting plates 48 on swing arms 49 mounted on the shaft 32 for pivotal movement thereabout. The plates 47 and 48 may be secured to each other in abutting engagement, in a suitable manner.

Keyed or otherwise secured to each shaft 32, for movement therewith, and with the bell crank 31 and applicator roll 12, is a swing arm 50. Each swing arm 50 extends rearwardly of the shaft 32 and forms a pivotal mounting at its rear or outer end for a connector 51 on the transverse pivot pin 52. The connector 51 is threaded or otherwise secured to the outer end of the piston rod 53, extensible from a fluid pressure cylinder 55. The cylinder 55 may be an air cylinder and has a piston (not shown) movable therein and connected with the piston rod 53, to effect relative movement between the coating bath pan 13 and swing arm 50 upon the admission of fluid under pressure to one end of said cylinder, and the release of fluid under pressure from the opposite end of said cylinder. The cylinder 55, its piston (not shown) and the piston rod 53 thus form an extensible link connecting the coating bath pan 13 to the swing arm 50 to move therewith as the applicator roll 12 is moved toward or from its operative positions into or out of a web threading position to maintain the coating bath pan in sealing engagement with the end dams 45 during the coating operation and threading of the web, but moving the coating bath pan away from the applicator roll and end dams 45, when it is desired to clean coating material from the pan.

As shown in FIGURES 1, 2 and 3, the cylinder 55 is provided with a piston rod end head 56, having trunnion pins 57 extending therefrom, journalled in bearing blocks 59 suitably secured to blocks 60 extending rearwardly of the end walls 46, beneath the bearing plate 47 and the mounting plate 48. The admission of fluid under pressure, such as air, to the piston rod end of the cylinder 55 will thus retract the piston rod 53 in said cylinder and retractibly move the coating bath pan with respect to the end dams 45 and applicator roll 12, to accommodate ready cleaning of the coating bath pan and applicator roll 12.

Referring now in particular to the supporting and loading mechanism for the doctor blade 15, the frame members 20 pivotally mounted between the feet 22, for movement about the pivot pins 25, are capable of moving the doctor blade 15 from the operative position shown in FIGURE 2 and into the clean up position shown in FIGURE 3. The support structure for the doctor back 16 and doctor blade 15 at each end of the doctor back is the same so the support structure for one end only need herein be shown and described in detail.

The frame member 20 is held in position and moved to its operative, web threading and clean up positions by a fluid pressure cylinder 61 having a piston rod 62 extensible therefrom, as shown in FIGURES 1, 2 and 3, the cylinder 61 has trunnion pins 63 extending from its piston rod end and journalled in the foot 22 in a suitable manner. The piston rod 62 has a connector 65 on its free end pivotally connected to an ear 66, depending from the frame member 20, on a pivot pin 67.

Movement of the frame member 20 to position the blade 15 into its clean up position is limited by transversely extending pin 69, removably mounted in the foot 22 and extending through an arcuate slot 70 in the frame member 20. As fluid under pressure is admitted to the piston rod end of the cylinder 61 and the frame member 20 is moved in a clockwise direction until the upper end portion of the slot 70 engages the pin 69, the doctor blade 15 will be free from the back-up roll in its web

threading position, as shown in FIGURE 2. When it is desired to move the doctor blade **15** into its clean up position, the pin **69** is removed from the slot **70** accommodating further movement of the frame member **20** for the balance of the stroke of the piston rod **62**, into the clean up position thereof.

The operative position of the frame member **20** and doctor blade **15** is determined by an adjustable stop in the form of a machine screw **71** threaded in a forwardly facing shouldered portion **72** of the foot **22** and locked in position by a lock nut **73**. The head of the machine screw **71** is adapted to abut an abutment face **75** on the frame member **20** and facing the shouldered portion **72**. The stop **71** may be so adjusted that the doctor blade **15** will be spaced from the back-up roll **11** the required distance to smooth the coating applied to the web, which may be from one-fourth to three-eighths inch. This distance, however, may be varied for different coating conditions.

The angle of the doctor blade with respect to the back-up roll **11** is maintained by a turnbuckle **76**, pivoted at one end to the frame member **20** on a pivot pin **77**. The opposite end of the turnbuckle **76** is pivoted to the swing arm **17** on a pivot pin **79**. Lengthening or shortening of the turnbuckle **76** will move the axis of the pivot pin **19** pivotally supporting the doctor back **16** on the swing arm **17**, in an arcuate path and afford a change of blade angle which may be from approximately 40° to approximately 60°, as indicated by broken lines in FIGURE 1.

The doctor back **16** and doctor blade **15** are held in position, and the doctor blade is loaded by two loading diaphragms **82** and **83** mounted in side-by-side relation with respect to each other and extending generally radially of the axis of pivotal movement of the doctor back. The loading diaphragms **82** and **83** act against a holding diaphragm **85**, also shown as extending generally radially of the axis of pivotal movement of the doctor back. The diaphragms **82**, **83** and **85**, like the diaphragms **36**, **36** may be types of air diaphragms which are known to the trade as air rides.

As shown in FIGURES 1, 2, 3 and 4, the diaphragms **82** and **83** abut a pressure pad **86** at one end and an opposing pressure pad **87** at the opposite ends thereof. The pressure pad **86** is secured to and extends inwardly of the swing arm **17**, while the pressure pad **87** is mounted on and extends downwardly of the doctor back **16**. The diaphragm **85** is interposed between a pressure pad **88** extending inwardly of the swing arm **17** and a pressure pad **89** mounted on and extending inwardly of the doctor back **16**.

The diaphragms **82** and **83** oppose the diaphragm **85** and are of greater capacity than the diaphragm **85**. The moment arms of the respective diaphragms **82**, **83** and **85** about the axis of the pivot shaft **19** may be so arranged that the doctor back **16** is completely balanced when the diaphragm **82** has a pressure of 39 p.s.i., the diaphragm **83** has a pressure of 39 p.s.i. and the diaphragm **85** has a pressure of 60 p.s.i. The adjustable stop **71** may then be so adjusted as to barely bring the blade into contact with the paper web when pressure is supplied to the head end of the cylinder **61**. Under the above conditions the doctor blade **15** is operating at zero blade pressure.

As the pressure in the diaphragm **85** is decreased, the diaphragms **82** and **83** will force the pressure pad **87** in a counter-clockwise direction about the axis of the pivot pin **19**. This will cause the doctor back **16** to rotate about the pivot pin **19** in a counter-clockwise direction and increase the blade pressure. Low blade pressure may thus be attained with high air pressures in the diaphragm **85**, which in the particular instance, may be 60 p.s.i.

Referring now to the graph shown in FIGURE 5 of the drawings, it may be seen from this figure that zero blade pressure is obtained with the diaphragm **85** at 60 p.s.i. The blade pressure may be increased by deflating the diaphragm **85** and when an air pressure of 22.5 p.s.i. is reached, the blade pressure will be 4.2 pounds per square inch. At this time, pressure in the diaphragm **85** has reached its minimum desirable value for accurate blade pressure regulation. For higher blade pressures the diaphragm **85** may be completely deflated and the diaphragm **83** may be deflated from 39 to 22.5 p.s.i. Pressure in the diaphragm **82** may be maintained at 39 p.s.i. By deflating the diaphragm **85** from 60 to 22.5 p.s.i. a range of blade pressures is obtained as represented by the line marked A. By inflating the diaphragm **83** from 22.5 to 60 p.s.i. with pressure in the diaphragm **85** at 22.5 p.s.i., a range of blade pressures is obtained as represented by the line marked B. Higher blade pressures may be obtained by inflating the diaphragm **82**.

In FIGURE 6, I have shown a second graph of air pressure against blade pressure, which requires less manipulation than the method shown in the graph of FIGURE 5, but is not as efficient as the method of the graph of FIGURE 5, since the diaphragms **82** and **83** must oppose a pressure of 20 p.s.i. in the diaphragm **85**, for the higher blade pressure. This method, however, has certain advantages over the method illustrated in FIGURE 5, since it requires less manipulation of valves, and the control structure is simpler.

In the graph shown in FIGURE 6 a blade pressure of zero pounds corresponds to an air pressure of 60 p.s.i. in the diaphragm **85** as indicated by line C. The pressures in diaphragms **82** and **83** are represented by lines D and E. To increase the blade pressure the air pressure is reduced in the diaphragm **85** (for a particular blade angle) according to the graphical representation shown by line C. The air pressure in the diaphragm **85** is preferably not reduced below 20 p.s.i. As soon as the lower limit of 20 p.s.i. for the air diaphragm is reached, the air diaphragm **83** may take the loading function. As previously mentioned, the air diaphragm **83** is inflated to a pressure of 39 p.s.i. and by increasing this pressure along line D in the graph of FIGURE 6 the blade pressure will increase. When a maximum pressure of 60 p.s.i. has been reached in the diaphragm **83**, the diaphragm **82** may then resume the blade loading function, and by inflating this last mentioned diaphragm, additional blade pressure may be obtained up to a blade pressure of 15 pounds per square inch when the diaphragm **82** is inflated to 60 p.s.i.

It should here be noted that lines C, D and E are inclined with respect to the X-axis of the graph at angles alpha, beta and gamma. These angles are a function of the moment arms of the respective diaphragms and of the blade angle. This graph, however, only indicates the general relationship of blade pressure versus air pressure and the various air diaphragms, and is divided into three distinct sections, each corresponding to the respective air diaphragms **82**, **83** and **85**. When operating in the section corresponding to the air diaphragm **85**, the air diaphragm **85** only is pressurized to provide the required blade pressure, while the air diaphragms **82** and **83** are maintained at their balancing pressure of 39 p.s.i. When operating in the section corresponding to the air diaphragm **83**, the air diaphragm **83** only is manipulated while the air diaphragm **85** is maintained at 20 p.s.i. and the air diaphragm **82** is maintained at its original balancing pressure of 39 p.s.i. When operating with blade pressures falling within the section corresponding to the air diaphragm **82**, the diaphragm **82** only is manipulated, while the air diaphragm **85** is maintained at 20 p.s.i. and the air diaphragm **83** is maintained at 60 p.s.i.

Referring now to the operation of the coating apparatus and the schematic air diagram shown in FIGURE 7, illustratively showing one manner in which the air diaphragm of the apparatus may be loaded and unloaded. When it is desired to wash the doctor blade **15** and coating pan **13**, as well as the applicator roll **12**, the diaphragms **82**, **83** and **85** are deflated under the control of a valve **90** in a pressure line **91**, connected with the dia-

phragm 82, and a valve 93 in a pressure line 94 connected with the diaphragms 83 and 85. The stop pin 69 is also removed from the slot 70 allowing the support member 20 and doctor blade 15 to be moved to the extreme clean up position shown in FIGURE 3 by the supply of air under pressure to the piston rod end of the cylinder 61. The applicator roll double diaphragm 36 is also deflated under the control of a valve 100 in a pressure line 96. Fluid under pressure is then supplied to the piston rod end of the cylinder 55. This will cause the applicator roll to move by gravity to the clean up position shown in FIGURE 3 and will effect pivotal movement of the coating pan 13 about the axis of the pivot pin 32 into the clean up position shown in FIGURE 3. Free access is then afforded to both sides of the doctor blade 15, to the applicator roll 12 and to the coating bath pan 13.

At the termination of the clean up operation, when it is desired to resume the coating operation, fluid under pressure is admitted to the head end of the cylinder 55 and released from the piston rod end of said cylinder to bring the coating bath pan into sealing engagement with the end dams 45, 45 as shown in FIGURE 2. The coating bath pan may then be filled with coating material. Fluid under pressure may then be admitted to the head end of the cylinder 61, to force the frame member 20 against the stop 71. The stop pins 69 may then be inserted in the slots 70. Fluid under pressure may then be released from the head end of the cylinder 61 to allow the frame member 20 to drop back to the web threading position shown in FIGURE 2. The web may now be threaded through the coater, and the draws may be tightened by manipulating the web metering or take-up rolls (not shown) in a conventional manner. Fluid under pressure may then be admitted to the head end of the cylinder 61 to move the abutment face of the frame member 20 into engagement with the stop 71, and to retain said frame member in engagement with said stop.

The valve 95 in the pressure line 96 is shown in FIGURE 7 as being a solenoid operated valve. This valve may be operated under the control of a pressure switch 97, connected in the line 91 through a pressure line 98. The pressure switch 97 is so arranged that the solenoid operated valve 95 cannot be energized until the air diaphragm 82 is completely deflated. When the air diaphragm 82 is completely deflated, the valve 95 will be opened to allow fluid under pressure to flow to the double air diaphragm 36 and effect movement of the applicator roll into its operative position, determined by the micrometer stops 43, engaging the bearing faces 44 on the bearing housings 29.

When the applicator roll 12 is in its operating position, a limit switch 99 will be engaged by the swing arm 31 and effect energization of and opening of the valve 93, to supply air under pressure to the air diaphragms 83 and 85. The valve 90 may then be opened to supply pressure to the air diaphragm 82 under the control of a manually adjustable flow control valve 101, regulating the pressure to the diaphragm 82 to supply sufficient pressure to obtain zero blade loading.

A holding circuit (not shown) may be provided for the solenoid coil of the valve 95 to hold the valve 95 open upon opening of the valve 90 to supply fluid under pressure to the diaphragm 82. Said holding circuit may be under the control of the limit switch 99 to maintain the diaphragms 36 energized during the coating operation and until the deenergization of the double diaphragms 36, under the control of a manually operable valve 100 downstream of the valve 95.

The valve 93 will also supply fluid under pressure to the diaphragms 83 and 85 under the control of manually adjustable flow control valves 103 and 105, to load said diaphragms at the required air pressures for the desired loading of the doctor blade 15. The machine is then ready to perform a coating operation.

It should here be understood that the fluid diaphragm of FIGURE 7 is shown for illustrative purposes only and that various arrangements of flow control valves and shut off valves may be provided to attain the proper loading of the blade, and that these valves may be operated under the control of individual hand levers or a single hand lever or by a conventional sequential control system, if desired.

When it is desired to stop the coating operation, the valve 100 is opened to effect deflation of the double diaphragm 36. The limit switch 99 will then effect the deenergization of the diaphragms 83 and 85. The diaphragm 82 may then be deenergized under the control of the manually operable valve 90, to cause the doctor blade 15 to drop away from the applicator roll.

It may be seen from the foregoing that I have provided a simple and improved form of flooded nip coater affording coordination between the positioning of the applicator roll into its operating position and the positioning of the doctor blade into its operating position.

It should further be understood that the flooded nip coater of applicant's invention applying low blade pressures with high air pressures is particularly adaptable for the application of heavy coating weights, which are generally applied with low blade pressure attained by low air pressures, and that by applicant's invention more accurate blade pressures can be attained than could be attained by prior low blade pressure coaters, in which the low blade pressures are attained by low air pressures, which are difficult to control because of air regulation problems, in that a slight variation in the line pressure gives considerable amplification in the blade pressure, which results in fluctuations of the coating weight applied to the web.

It may further be seen that the coater of the present invention affords a more practical and easier wash up operation of the coating apparatus and completely exposes both sides of the doctor blade facilitating the cleaning and adjustment of the same.

It may further be seen that while the doctor blade arrangement of the present invention is particularly adaptable for controlling the blade pressures of a flooded nip coater where the coating is applied to the traveling web ahead of the trailing blade by means of an applicator roll, that the blade loading apparatus of the present invention is also adaptable for puddle type coaters, wherein a pool of coating material is held between a blade and the traveling web as well as in various other coating mechanisms, in which an excess of coating is applied to the traveling web and the final coating weight retained on the web, is controlled by a blade.

While I have herein shown and described one form in which the invention may be attained, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof as set forth in the claims appended hereto.

I claim as my invention:

1. In a low pressure loading device for doctoring and in combination with a back up roll adapted to have a web trained partially thereabout,

a pair of laterally spaced upright support arms,

a doctor back trunnioned to said support arms,

a doctor blade on said doctor back cooperating with the web passing about said back up roll,

and means for maintaining a predetermined pressure between said doctor blade and web comprising,

independent oppositely acting fluid pressure operated loading devices disposed between opposite sides of at least one of said support arms and said doctor back and extending generally radially of the pivotal axis of said doctor back,

and means operable to independently supply fluid under pressure to said loading devices to simultaneously place opposite rotating forces on said doctor back and to maintain said doctor back in position

to engage said doctor blade with said web at a preselected low pressure.

2. A doctor blade loading means in accordance with claim 1 wherein

the fluid pressure operated loading devices include a single high pressure diaphragm on one side of said support arm and adapted to exert pressure on said doctor back in a load-relieving direction and two independently operable high pressure diaphragms on the opposite side of said support and adapted to exert pressure on said doctor back in a load applying direction.

3. In a low pressure loading device for doctoring and in combination with a back up roll adapted to have a web partially trained thereabout,

a pair of laterally spaced upright support arms,

a doctor back trunnioned to said arms,

a doctor blade extending along said doctor back for doctoring cooperation with a web passing about said back up roll,

and means for maintaining a predetermined doctoring pressure on said doctor blade comprising,

two oppositely facing support pads mounted on at least one of said support arms and extending radially of the axis of pivotal adjustment of said doctor back,

two doctor back pressure pads mounted on said doctor back, each facing one of said first mentioned support pads and each extending parallel to an associated support pad,

a fluid pressure operated means interposed between one of said support pads and an associated doctor back pressure pad,

opposing fluid pressure operated means interposed between the other support pad and an associated doctor back pressure pad,

said fluid pressure operated means being independently operable to apply a preselected doctoring pressure on said doctor blade, determined by the difference in pressure exerted by said fluid pressure operated means,

and both of said fluid pressure operated means simultaneously placing oppositely rotating forces on said doctor back.

4. A doctor blade loading apparatus in accordance with claim 3

wherein one fluid pressure operated means comprises

a single fluid pressure operated diaphragm interposed between one of said first support pads and an adjacent parallel doctor back pressure pad, to exert pressure on said doctor back in a load-relieving direction,

and wherein the opposing fluid pressure operated means comprises

two aligned side-by-side diaphragms interposed between the other support pad and an adjacent doctor back pressure pad,

and wherein said last mentioned diaphragms exert pressure on said doctor back in load applying directions.

5. A doctor blade loading apparatus in accordance with claim 3

wherein one fluid pressure operated means comprises

a single diaphragm extending generally radially of the axis of turning movement of said doctor back and interposed between one of said support pads and an associated parallel doctor back pressure pad, for exerting pressure on said doctor back in a load relieving direction,

wherein the opposing fluid pressure operated means comprises

two aligned fluid pressure operated diaphragms extending generally radially of the axis of turning movement of said doctor back and interposed between the other support pad and the adjacent parallel doctor back pressure pad to exert pressure on said doctor back in a load-applying direction,

and wherein fluid pressure control means are provided to independently supply fluid under pressure to said diaphragms to effect the loading of said doctor blade at a preselected low pressure.

6. In a low pressure loading device for doctoring and in combination with a back up roll having a web trained partially thereabout,

a main frame,

a frame member transversely pivoted to said main frame and extending upwardly therefrom,

means for tilting said frame member and maintaining said frame member in position,

two laterally spaced upright arms transversely pivoted to said frame member and extending therefrom toward the back up roll,

a doctor back transversely pivoted to said arms and having a doctor blade extending therealong for doctoring cooperation with the web passing about said back up roll,

stop means on said main frame engaging said movable frame member and determining the doctoring position of said doctor blade,

link means adjustably connecting said frame member with said upright arms and determining the blade angle of said doctor blade,

and opposed fluid pressure operated loading means connected between at least one of said arms and said doctor back and loading said doctor blade at a preselected doctoring pressure.

7. A loading device for doctoring in accordance with claim 6

wherein the fluid pressure operated loading means include opposing high pressure fluid pressure operated diaphragms extending generally radially of the axis of pivotal movement of said doctor back and exerting angular pressure on said doctor back, one diaphragm opposing the other, and fluid pressure operated means supplying fluid under pressure to said diaphragms independently of each other to effect the loading of the doctor blade at a preselected pressure.

8. A doctor back loading device in accordance with claim 6

wherein the fluid pressure operated loading means comprise a diaphragm connected between one of said support arms and said doctor back and extending generally radially of the axis of pivotal movement of said doctor back and exerting angular pressure on said doctor back in a load relieving direction,

and wherein two independently operable high pressure diaphragms of a greater combined capacity than the capacity of said first mentioned diaphragm are interposed between said support arm and doctor back and exerting angular pressure on said doctor back to turn said doctor back in a load applying direction and load said doctor blade at a preselected pressure.

9. In a device for coating a traveling paper web, in combination

a back up roll partially wrapped by a traveling web,

a coating bath pan disposed beneath said back up roll,

an applicator roll partially immersed in said pan and in coating nip defining relation with respect to said back up roll,

a doctor blade on the outgoing side of said applicator roll,

movable mounting means for said doctor blade moving said doctor blade into a doctoring position, a web threading position and a cleaning position comprising,

a doctor back,

laterally spaced support arms forming a pivotal mounting for said doctor back,

a main frame,

an upright frame member transversely pivoted to said main frame and extending upwardly therefrom,

means transversely pivoting said arms to said frame member for movement about a pivotal axis spaced outwardly of the axis of pivotal movement of said doctor back,

linkage means pivotally connected between said frame member and at least one of said arms for determining the doctoring angle of said doctor blade,

loading means interposed between at least one of said arms and said doctor back for loading said doctor blade at a predetermined doctoring pressure,

stop means engageable with said frame member, limiting movement of said doctor blade into a doctoring position,

other stop means limiting movement of said doctor blade into a web threading position,

means moving said frame member into engagement with said first mentioned stop means to maintain said doctor blade in a doctoring position, and moving said frame member away from said first mentioned stop means to the limit of movement thereof determined by said second mentioned stop means, to retain said doctor blade in a web threading position,

said second mentioned stop means being releasable to accommodate further movement of said doctor blade away from said back up roll into a clean up position.

10. In a device for coating a traveling paper web, in combination

a main frame,

a back up roll journalled in said main frame and partially wrapped by a web to be coated,

a coating bath pan disposed beneath said back up roll,

an applicator roll partially immersed in said pan and in coating nip defining relation with respect to said back up roll,

a frame member transversely pivoted to said main frame and extending upwardly therefrom,

hydraulic cylinder and piston means connected between said main frame and said frame member and retaining said frame member in position and tilting said frame member with respect to said main frame,

a pair of laterally spaced support arms pivotally supported on said frame member and extending downwardly of the axis of pivotal connection of said arms to said frame member,

a doctor back transversely pivoted on said support arms,

a doctor blade mounted on and extending along said doctor back,

fluid pressure operated loading means interposed between at least one arm and said doctor back and exerting load applying pressure on the doctor blade,

link means pivotally connected between said frame member and at least one of said arms and determining the angle of said doctor blade,

a stop on said main frame limiting movement of said frame member and doctor blade into a doctoring position,

a second stop on said main frame engageable with said frame member and limiting tilting movement of said frame member away from said back up roll into a web threading position,

said second stop being releasable to accommodate movement of said frame member and doctor blade into a clean up position.

11. A device for coating a traveling paper web in accordance with claim **10**

wherein the link means is adjustable to vary the angle of the doctor blade with respect to the back up roll,

wherein the first stop means is adjustable to vary the spacing between the doctor blade and the back up roll,

and wherein the other stop means consists in a releasable pin and slot connection between said main frame and said frame member.

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