May 22, 1973 D. R. CURTIS 3,734,821

HEADBOX FOR CYLINDER ROLL PAPERMAKING MACHINE

Filed Dec. 14, 1970

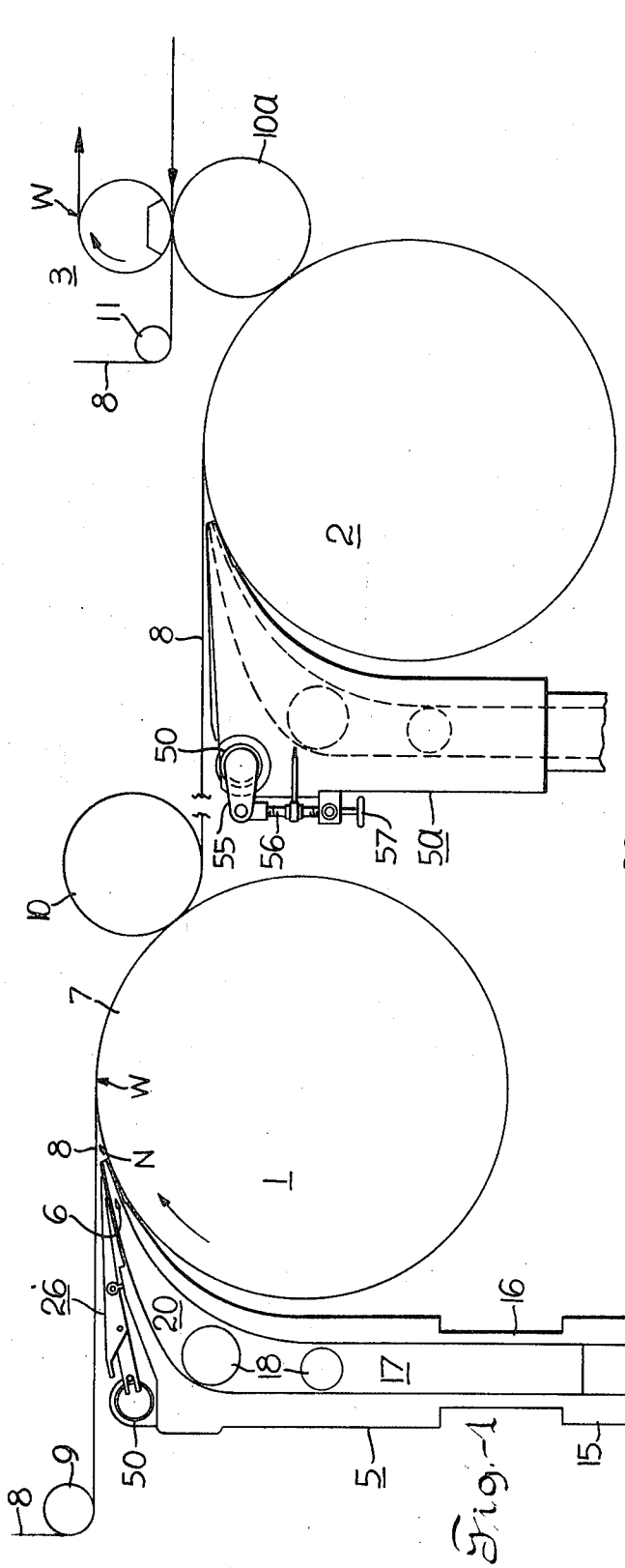


Fig. 1

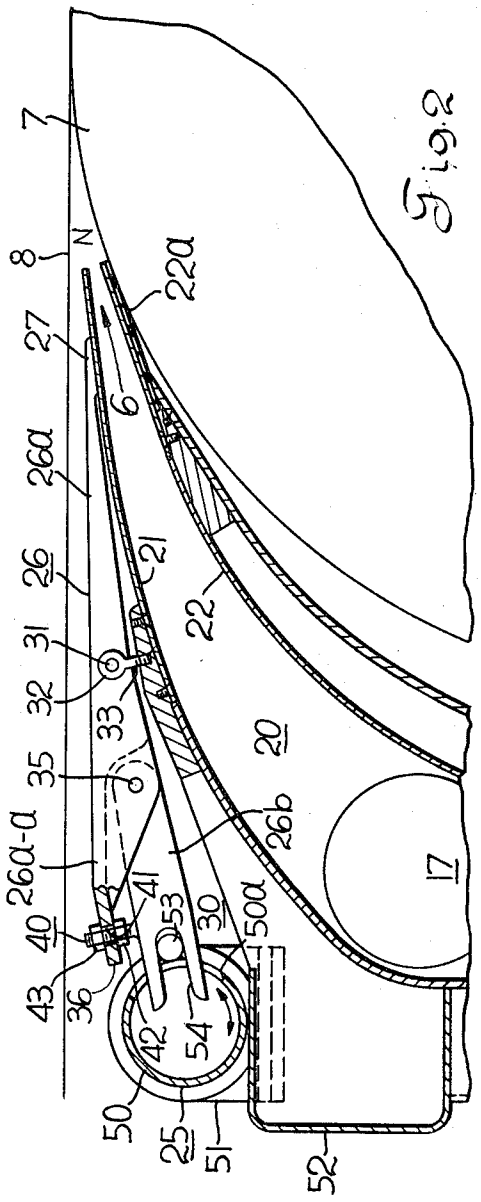


Fig. 2

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HEADBOX FOR CYLINDER ROLL PAPERMAKING MACHINE

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ABSTRACT OF THE DISCLOSURE

A headbox is disclosed having a vertical flow chamber connected to a curved and tapered nozzle which defines a slice opening for jetting paper stock from the flow chamber along a path having both horizontal and vertical components and into a nip above a cylindrical forming roll and beneath a felt tangentially engaging an upper portion of the forming roll. The headbox nozzle has an upper and lower lip projecting into the nip. An adjusting mechanism is provided for the upper lip which includes a plurality of adjusting arms each connected on one end to the top of the upper lip proximate to the slice opening. The arm projects from the slice opening toward the flow chamber end of the nozzle and diverges from the upper lip to define a generally wedge-shaped space between the arm and the upper lip. A horizontal pivot is connected to the arm intermediate the ends thereof. A journal is connected to the pivot and has a link portion which spans the space between the adjusting arm and the upper lip and is connected to the upper lip. The adjusting arm is made up of a first and a second section pivotally connected by a horizontal pin at a location between the journal and the flow chamber end of the adjusting arm. The section that comprises the slice opening end of the arm has a portion projecting around the pin with a terminal end of this portion vertically spaced above the other of the sections. A vertically adjustable link connects this terminal end portion of the one section, to said other of the sections, to provide for holding the two sections of each arm in variable preselected angular positions relative to each other for warping the upper slice lip to provide a desired profile to the upper lip. A horizontal rotatable drive shaft is mounted on the headbox adjacent the flow chamber end of the adjusting arm and this shaft has a horizontal pin attached to the periphery of the shaft which projects into a slot defined in the adjacent end of the arm. Rotation of the drive shaft raises and lowers the connected end of the adjusting arm about the pivot and bends the upper lip to vertically adjust the position of the slice opening end of the upper lip relative to the lower lip.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a papermaking machine in which pulp stock is directed by a headbox in a generally tangential direction at a forming roll, and in particular to a headbox for such a machine and having an adjustable slice opening control.

Description of the prior art

Prior art patents relating to web formation on forming rolls indicate that perhaps the first type, and apparently the earliest of such machines to be developed, involved a pervious cylinder (sometimes called a cylinder mold) that rotated partly submerged in a vat containing pulp, and a layer of pulp was brought up from the vat on the revolving mold. U.S. patents that illustrate typical machines of that type include U.S. 206,106 and U.S. 206,107 of 1878; and US. 1,578,729 of 1926.

The seconds, and apparently next type of such machine to appear, involves a pervious cylinder with paper stock jetted thereon from a headbox such as had been developed for Fourdrinier machines. U.S. Pat. 1,856,081 of 1932 (see FIG. 4) discloses such a machine.

A third type of such machine involves a pervious cylinder part of which is lapped by a felt belt in contact with part, but not all, of the outer surface of the cylinder and a headbox that jets paper stock upwardly onto the upwardly turning side of the cylinder and beneath the felt belt where a web of paper is formed. The newly formed web is lifted off of the cylinder by the felt as the felt is lifted off the cylinder. Patents that illustrate typical machines of that type include U.S. 2,162,097 of 1939; U.S. 2,934,140 of 1960 and U.S. 3,252,853 of 1966.

SUMMARY OF THE INVENTION

The present invention relates to a headbox for the aforesaid third type of machine for forming paper on a cylindrical web forming roll.

It is an object of the present invention to provide a headbox for such machines, which is provided with a stock discharge nozzle having an upper and lower lip that in vertical cross section define a thin wedge leading to a slice opening, for projecting into a small angle nip of a felt lapping a forming roll, and a new and improved low profile adjusting mechanism for the upper lip arranged along the top of and to the rear of the upper lip to provide a minimum interference to locating the nozzle close to the nip between the felt and the forming roll.

According to a preferred embodiment of the present invention a headbox is provided with a vertical flow chamber connected to a curved and tapered nozzle which defines a slice opening for jetting paper stock from the flow chamber along a path having both horizontal and vertical components and into a nip above a cylindrical forming roll and beneath a felt tangentialy engaging an upper portion of the forming roll. The headbox nozzle has an upper and lower lip projecting into the nip. An adjusting mechanism is provided for the upper lip which includes a plurality of adjusting arms each connected on one end to the top of the upper lip proximate to the slice opening. The arm projects from the slice opening toward the flow chamber end of the nozzle and diverges from the upper lip to define a generally wedge-shaped space between the arm and the upper lip. A horizontal pivot is connected to the arm intermediate the ends thereof. A journal is connected to the pivot and has a link portion which spans the space between the adjusting arm and the upper lip and is connected to the upper lip. A horizontal rotatable drive shaft is mounted on the headbox adjacent the flow chamber end of the adjusting arm and this shaft has a horizontal pin attached to the periphery of the shaft which projects into a slot defined in the adjacent end of the arm. Rotation of the drive shaft raises and lowers the connected end of the adjusting arm about the pivot and bends the upper lip to vertically adjust the position of the slice opening end of the upper lip relative to the lower lip.

Because the pivot about which the adjusting arm turns is spaced well to the rear of the slice opening, and the drive shaft means is even farther to the rear, the nozzle and adjusting arm can be made with a very low profile and small angle taper (as appears in vertical cross section) and the nozzle therefore may be inserted deep within a small angle nip and close to the location where the felt comes in contact with the forming cylinder.

According to another feature of the invention the adjusting arm is made up of a first and a second section pivotally connected by a horizontal pin at a location be-

tween the journal and the flow chamber end of the adjusting arm. The section that comprises the slice opening end of the arm has a portion projecting around the pin with a terminal end of this portion vertically spaced above the other of the sections. A vertically adjustable link connects this terminal end portion of the one section, to said other of the sections, to provide for holding the two sections of each arm in variable preselected angular positions relative to each other for warping the upper lip to provide the upper lip with a desired profile.

Other features and objects of the invention that have been attained will appear from the more detailed description to follow with reference to an embodiment of the present invention shown in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 of the accompanying drawing shows diagrammatically a side elevation, partly in section, a papermaking machine with headboxes according to the present invention; and

FIG. 2 is an enlarged fragmentary view partially in section of a portion of such a headbox.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the drawing, a portion of a papermaking machine is shown for forming fiber and water pulp into a web of heavy paper, paperboard or multilayer paper. A first stage web forming unit **1** is provided for forming an initial web W, and a final stage forming unit **2** is provided for depositing a final layer of pulp beneath a wet web formed in such as the first stage forming unit **1**. In a commercial installation several intermediate stage forming units (not shown) may be arranged in series between the first and final stage units here identified with the reference numerals **1** and **2**. A typical commercial installation may have seven stages each comprising a forming unit substantially identical to the units **1**, **2** shown in the drawing. At the web outrun end of the final stage forming unit **2**, a pickup press **3** is provided to pickup and transport the web W to a press section and drying section of the papermaking machine (not shown), both of which may be of conventional design and construction for heavy or multilayer paper such as will be formed by a series of forming units such as the units **1**, **2**.

Referring to the first stage web forming unit **1** shown in FIG. 1, a headbox **5** is provided with a slice opening **6** for discharging and directing paper stock along a generally tangential path toward a top portion of a forming roll **7** which rotates in the direction indicated by an arrow. An endless loop fabric (felt) belt **8** is arranged and guided by a turning roll **9** upstream of headbox **5** and a pickup roll **10** downstream of headbox **5** to lap the top and part of the down turning side of forming roll **7**. The belt **8** extends through each forming unit and at the pickup press **3** turns and is guided by one or more turning rolls **11** back to the first stage unit. The pickup roll **10** of unit **1**, a pickup roll **10***a* of unit **2** and pickup rolls for units intermediate units **1** and **2** (and not shown) are all therefore within the continuous and endless loop of the belt **8**.

The headbox **5** is provided with a stock entrance manifold **15** and a plurality of tubes **16** connecting manifold **15** to a vertical flow chamber **17**. One or more hollow perforated distributor rolls **18** may be provided in flow chamber **17**. The vertical flow chamber **17** is connected to a curved and tapered nozzle **20** which defines the slice opening **6** for jetting paper stock from the flow chamber **17** along a path having both horizontal and vertical components and into a nip N above the uylindrical forming roll **7** and beneath the felt **8** trangentially engaging the upper portion of the forming roll **7**.

Referring to FIG. 2, the headbox nozzle **20** has an upper lip **21** and lower lip **22** projecting into the nip N. A polyethylene strip **22***a* may be attached to the lower surface of lip **22**. An adjusting mechanism **25** is provided for the upper lip **21** which includes a plurality of adjusting arms **26** each connected on one end **27** to the top of the upper lip **21** proximate to the slice opening **6**. The arm **26** projects from the slice opening **6** back toward the flow chamber **17** and diverges from the upper lip **21** to define a generally wedge-shaped space **30** between the arm **26** and the upper lip **21**. A horizontal pivot **31** is connected to the arm **26** intermediate the ends thereof. A journal **32** is connected to the pivot **31** and has a link portion **33** which spans the space **30** between the adjusting arm **26** and the upper lip **21** and is connected to the upper lip **21**. The adjusting arm **26** is made up of a first section **26***a* and a second section **26***b* pivotally connected by a horizontal pin **35** at a location between the journal **32** and the flow chamber end of the adjusting arm **26**. The section **26***a*, that comprises the slice opening end of the arm **26**, has a portion **26***a–a* projecting around the pin **35** with a terminal end **36** of this portion **26***a–a* vertically spaced above the other of the sections **26***b*. A vertically adjustable link **40** connects this terminal end **36** of the one section **26***a–a*, to said other of the sections **26***b*, to provide for holding the two sections **26***a*, **26***b* of each arm **26** in variable preselected angular positions relative to each other.

The link **40** is shown projecting vertically through a hole **41** in the terminal end portion **26***a–a*. The link **40** is threaded to engage a holding nut **42** beneath the terminal end portion **26***a–a* and a holding nut **43** above terminal end portion **26***a–a*. The nuts **42**, **43** hold the section **26***a–a* of arm **26** in selected angular positions relative to the section **26***b* of arm **26**.

A horizontal rotatable drive shaft **50** is journaled in a bracket **51** carried by a portion **52** of headbox **5** to the rear of nozzle **20**. The shaft **50** has a horizontal pin **53** attached to the periphery of the shaft **50** to span a slot opening **50***a* in shaft **50**. Pin **53** projects into a slot **54** defined in the adjacent end of the arm **26***b* and the end of arm **26** defining slot **54** projects through slot **50***a* and into shaft **50**. Referring to FIG. 1 and headbox **5***a* of unit **2**, a crank lever **55** is connected to the end of drive shaft **50**. A jack screw assembly **56** carried by headbox **5***a* is connected to the crank lever **55**. The jack screw **56** may be operated by power means (not shown) or by a hand wheel **57**. When jack screw **56** is operated to raise or lower the connected end of crank lever **55** shaft **50** is rotated about its central axis. Rotation of the drive shaft **50** raises and lowers the connected end of the adjusting arm **26** about the pivot **31** and bends the upper lip **21** to vertically adjust the position of the slice opening end of the upper lip **21** relative to the lower lip **22**.

In the operation of forming unit **1**, a dilute stock having from about ½% to 1½% fibers dispersed in 99½% to 98½% water, is discharged from slice opening **6** of headbox **5**, into the nip N. As the belt **8** laps forming roll **7**, with stock therebetween, water is squeezed from the stock and the dewatered stock forms a web of fibers. The belt **8** and web W are lifted from forming roll **7** by pickup roll **10** and the felt belt **8** carries the web W through such intermediate stages as may be provided and finally through the final stage forming unit **2** to the pickup press **3**. The nuts **42** and **43** may be set so link **40** establishes a desired angular relationship between the sections **26***a* and **26***b* of each adjusting arm **26** for warping the upper lip to provide the upper lip with a desired profile. Rotation of drive shaft **50** raises and lowers the connected end of the adjusting arm **26** about the pivot **31** and bends the upper lip **21** to vertically adjust the position of the slice opening **6**. As has been stated, because the pivot **31** about which the adjusting arm **26** turns is spaced well to the rear of the slice opening **6**, and the drive shaft **50** is even farther to the rear, the noz-

zle **20** and adjusting arm **26** can be made with a very low profile and small angle taper and the nozzle **20** therefore may be inserted deep within the nip N and close to the location where the felt belt **8** comes in contact with the forming cylinder **7**.

From the foregoing detailed description of the present invention it has been shown how the objects of the present invention have been attained in a preferred manner. However, modification and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included in the scope of this invention. Thus, the scope of the invention is intended to be limited only by the scope of the claims such as are or may hereafter be, appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a headbox having a flow chamber connected to a tapered nozzle defining a slice opening for jetting paper stock from the flow chamber into a nip between a cylindrical forming roll and a felt tangentially engaging and lapping a portion of the forming roll, and said headbox having a first lip for projecting into such a nip adjacent such a roll and a second lip vertically spaced from the first lip for projecting into such a nip adjacent such a felt, an improved adjusting mechanism for the second lip comprising:

(a) an adjusting arm connected on one end to an outer surface of the second lip proximate to the slice opening, projecting toward the flow chamber end of the nozzle and diverging from the second lip to define a generally wedge-shaped space between the arm and the second lip;

(b) a horizontal pivot connected to the arm intermediate the ends thereof;

(c) a journal connected to the pivot and having a link portion spanning the space between the adjusting arm and the second lip and connected to the second lip; and

(d) drive means mounted on the headbox and connected to an end of the adjusting arm remote from the slice opening, and operative to raise and lower the connected end of the adjusting arm about the pivot and vertically adjust the position of the slice opening end of the second lip relative to the first lip.

2. In a headbox according to claim **1**, the drive means comprising a horizontal rotatable drive shaft mounted on the headbox adjacent an end of the adjusting arm remote from the slice opening with the shaft having a peripheral connection with the adjacent end of the adjusting arm; and means connected to the drive shaft for turning the drive shaft about a horizontal axis central thereof to raise and lower the connected end of the adjusting arm about its pivot and vertically adjust the position of the slice opening end of the second lip relative to the first lip.

3. In a headbox according to claim **2**, the peripheral connection of the shaft to the adjusting arm being provided by a horizontal pin attached to the periphery of the shaft and projecting into a slot defined in the end of the arm.

4. In a headbox according to claim **1** the adjusting arm comprises a first and a second section pivotally connected by a horizontal pin at a location between the journal and the drive means, one of said arm sections has a portion projecting around the pin and toward the flow chamber end of the arm with a terminal end of this portion vertically spaced from the other of the sections, and a vertically adjustable link connecting said terminal portion of the one section to said other of the sections to provide for holding the two sections in variable preselected angular positions relative to each other for warping the second lip to provide the second lip with a selected profile.

5. In a headbox having a vertical flow chamber connected to a curved and tapered nozzle defining a slice opening for jetting paper stock from the flow chamber along a path having both horizontal and vertical components and into a nip above a cylindrical forming roll and beneath a felt tangentially engaging and lapping an upper portion of the forming roll, and said headbox having an upper and lower lip for projecting into such a nip, an improved adjusting mechanism for the upper lip comprising:

(a) an adjusting arm connected on one end to the top of the upper lip proximate to the slice opening, projecting toward the flow chamber end of the nozzle and diverging from the upper lip to define a generally wedge-shaped space between the arm and the upper lip;

(b) a horizontal pivot connected to the arm intermediate the ends thereof;

(c) a journal connected to the pivot and having a link portion spanning the space between the adjusting arm and the upper lip and connected to the upper lip; and

(d) drive means mounted on the headbox and connected to an end of the adjusting arm remote from the slice opening, and operative to raise and lower the connected end of the adjusting arm about the pivot and vertically adjust the position of the slice opening end of the upper lip relative to the lower lip.

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