June 12, 1973 D. B. DE NOYER 3,738,910

NOZZLE ADJUSTING ARRANGEMENT FOR A PAPERMAKING MACHINE HEADBOX

Filed Feb. 8, 1972 4 Sheets-Sheet 1

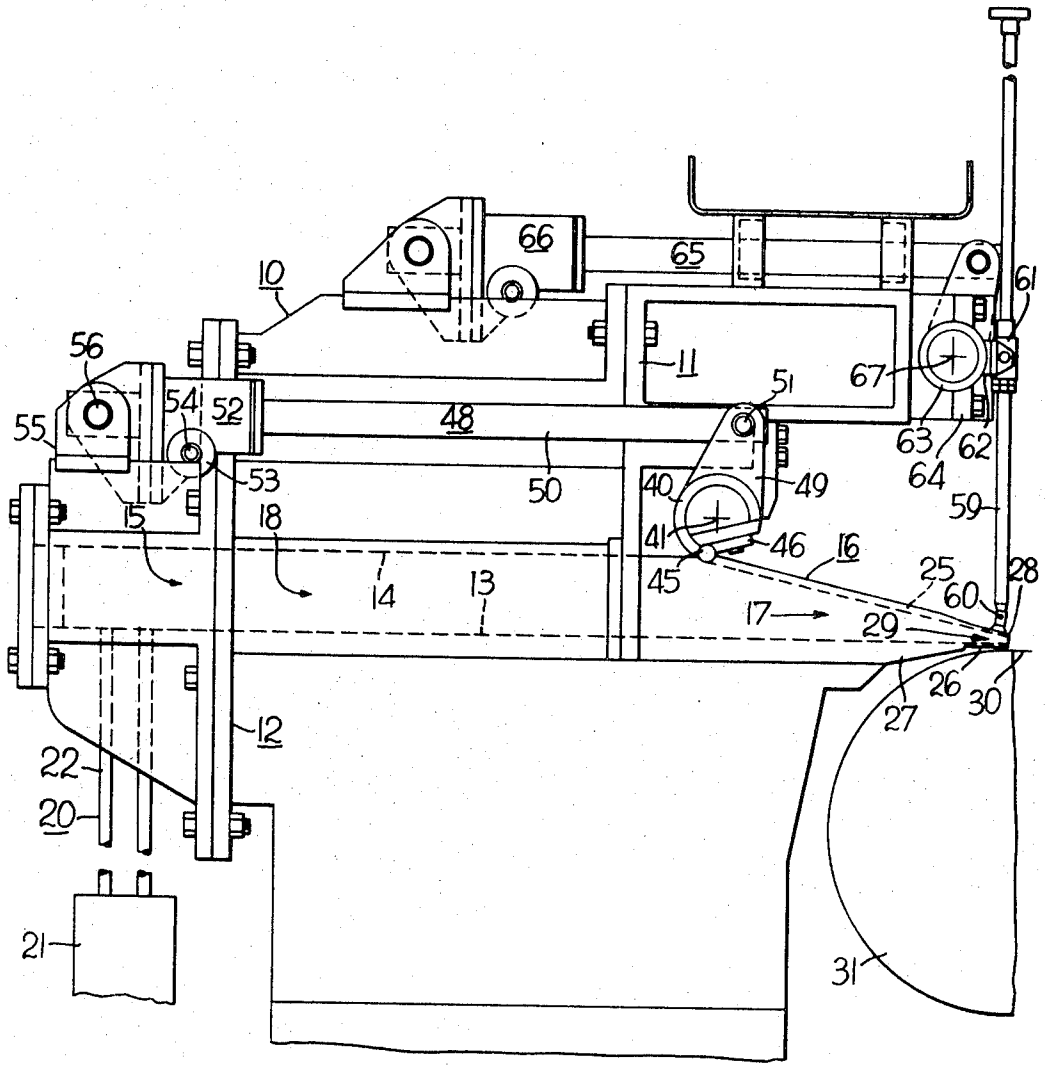


Fig. 1

NOZZLE ADJUSTING ARRANGEMENT FOR A PAPERMAKING MACHINE HEADBOX

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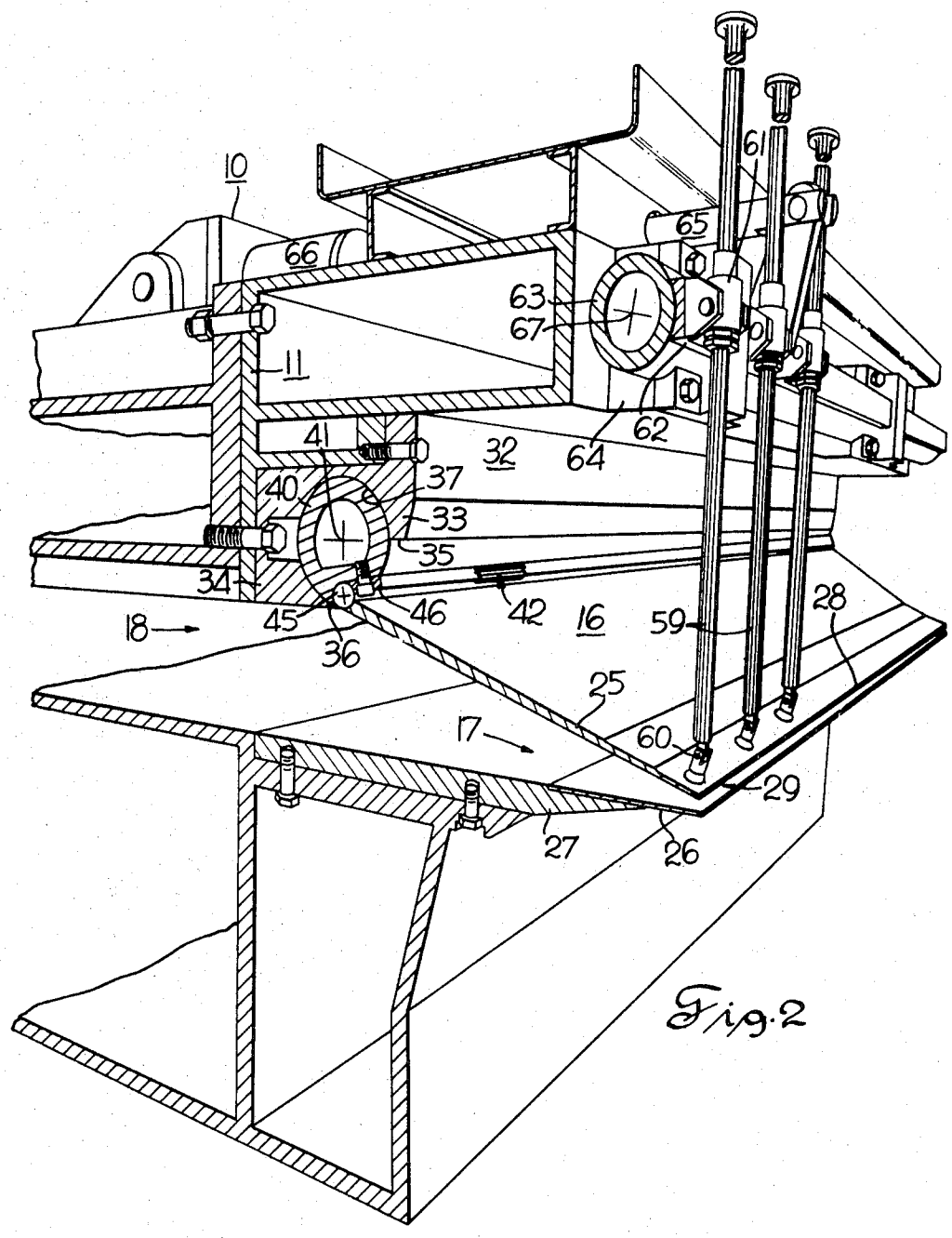


Fig. 2

June 12, 1973 D. B. DE NOYER 3,738,910

NOZZLE ADJUSTING ARRANGEMENT FOR A PAPERMAKING MACHINE HEADBOX

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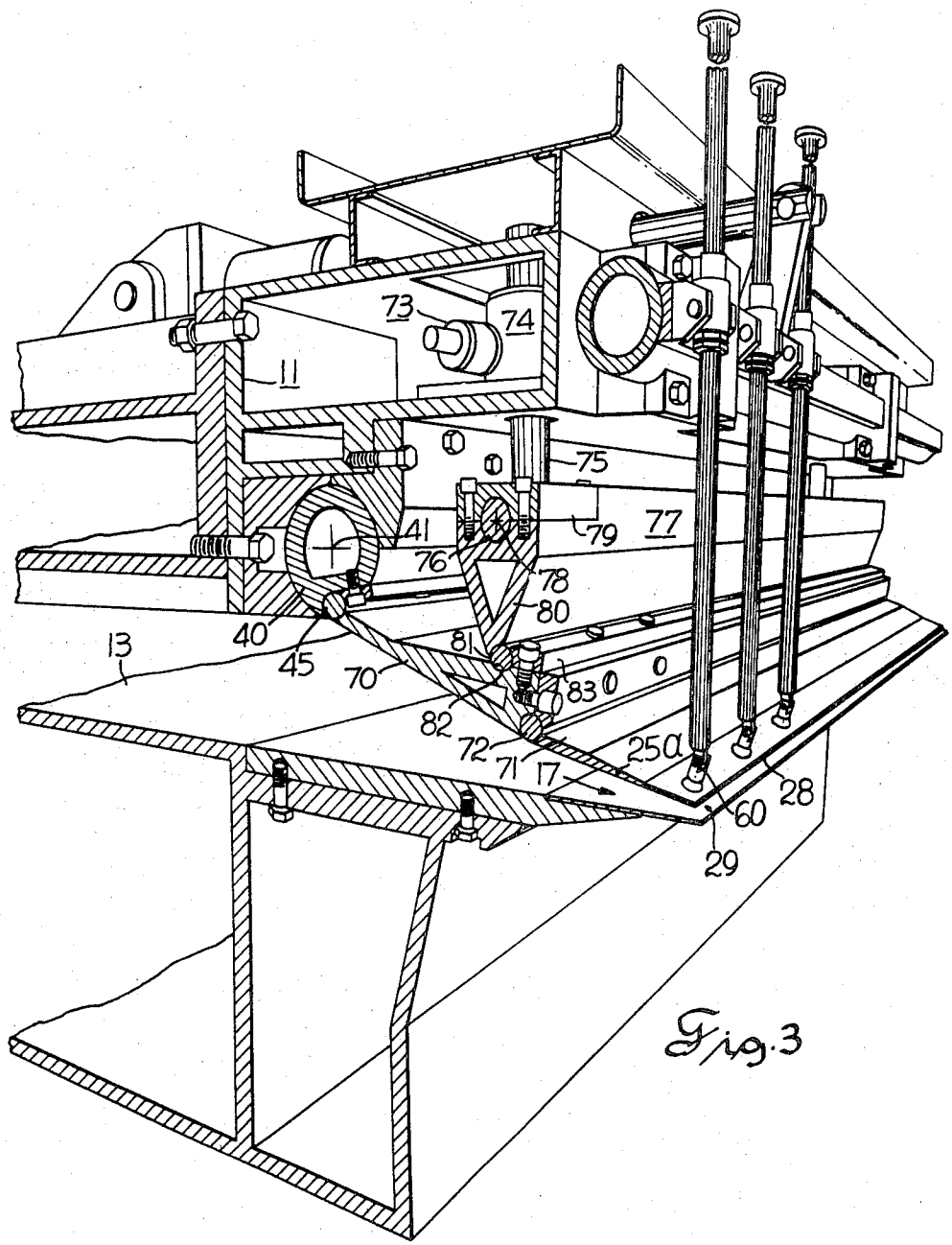


Fig. 3

June 12, 1973 D. B. DE NOYER 3,738,910

NOZZLE ADJUSTING ARRANGEMENT FOR A PAPERMAKING MACHINE HEADBOX

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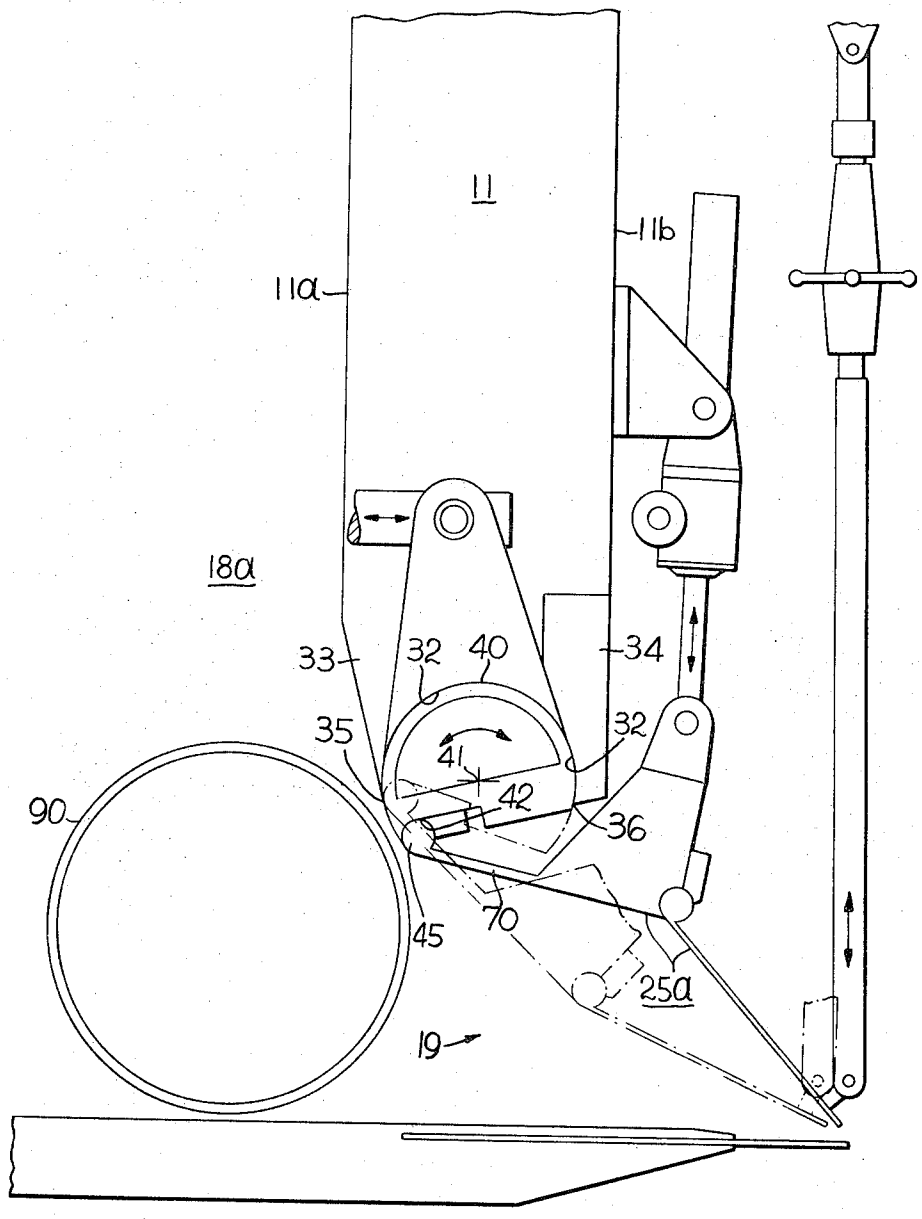


Fig. 4

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3,738,910

NOZZLE ADJUSTING ARRANGEMENT FOR A PAPERMAKING MACHINE HEADBOX

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Continuation-in-part of application Ser. No. 81,823, Oct. 19, 1970. This application Feb. 8, 1972, Ser. No. 224,572

Int. Cl. D21f *1/02*

U.S. Cl. 162—347 9 Claims

ABSTRACT OF THE DISCLOSURE

A headbox for a papermaking machine is disclosed with an arrangement for adjusting the upper lip of a tapered nozzle paper stock discharge passage. A cylindrical bearing is supported by headbox front wall structure for rotation about a horizontal axis central to the cylindrical bearing. The upstream edge of the upper lip of the stock discharge nozzle is journaled in a socket defined in the outer periphery of the cylindrical bearing for supporting the upstream edge of the upper lip relative to the bearing. A linkage is connected to the cylindrical bearing for rotating the cylindrical bearing about its central axis and moving the upper lip with the upstream and downstream edges thereof moving along respective paths each having a horizontal component.

This is a continuation-in-part of copending application Ser. No. 81,823, filed Oct. 19, 1970, now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to the construction of a headbox for spreading dilute paper stock across the entire width of a paper web former and particularly to a construction of a discharge nozzle defined by an upper lip and a lower lip projecting from the box, with an arrangement for adjusting the upper lip of the nozzle to move horizontally away from and back toward the box, in addition to adjusting the vertical dimension of a slice opening defined between the upper lip and the lower lip.

Description of the prior art

The prior art has long known of the desirability of being able to advance and retract the position of the downstream edge of the upper lip of a stock discharging nozzle relative to a web former upon which pulp stock is deposited, through a greater range of horizontal adjustments than is achieved by merely pivoting the upper lip about its upstream edge. One way known to the prior art for accomplishing such an adjustment is to provide for delivering stock to the headbox through flexible conduits and provide for moving the entire headbox toward and back away from the web former. Such an arrangement is described in U.S. Pat. 2,308,370 of 1943. Another way known to the prior art, that utilizes nonflexible means for delivering stock to a headbox, provides for solely vertical movement of the upstream edge of an upper lip and both vertical and horizontal movement of the downstream edge of the upper lip. In such an arrangement a force applied to vertically raise or lower the upstream edge of the upper lip in a single vertical plane by an amount greater or less than a vertical component of movement of the downstream edge of the upper lip, necessarily results in the downstream edge of the upper lip moving toward or back away from a web former upon which pulp stock is deposited. Such an operation is shown in FIG. 4 of U.S. Pat. 2,782,692 of 1957. Still another way known to the prior art that utilizes nonflexible means to deliver stock to a headbox, does not limit movement of the upstream edge of an upper lip to solely vertical movement, but provides for both vertical and horizontal movement of the upstream edge of an upper lip by connecting the upstream edge of an upper lip to a tiltable headbox front wall which is pivotal about a horizontal axis parallel to the front wall. An example of such an arrangement is disclosed in U.S. Pat. 3,332,837 of 1967. Still another way known to the prior art that does not require flexible means to deliver stock to a headbox or a tiltable headbox front wall is shown in British Pat. 697,321 of 1953. This British patent discloses an arrangement in which the upstream edge of an upper lip is supported by a flat bearing surface above and to rear of the upper lip. This flat bearing surface is sloped downwardly in a direction toward the upper lip and supports the upstream edge of the upper lip for movement away from and back toward the headbox along a downwardly sloped plane defined by the flat bearing surface. Another arrangement such as shown in U.S. Pat. 3,562,106 utilizes two part upper lip having an upstream end that pivots about an axis that is fixed relative to a nonmovable headbox front wall.

Still another arrangement known to the prior art is disclosed in a trade journal of the Technical Association of the pulp and Paper Industry (TAPPI) February 1959, vol. 42, No. 2, page 143. This publication shows an arrangement in which the rear edge of an upper slice lip is supported to turn about a fixed horizontal axis by structure which does not contribute to the rigidity of the front wall of the headbox. The manner in which the present invention differs from such prior art structures will appear from the description to follow.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a headbox having a stationary front wall, with a new and improved arrangement for moving both the upstream and downstream edges of an upper lip of a stock discharge nozzle, along respective paths with a horizontal component away from and back toward the headbox without the need to first shutdown the machine and with an arrangement which provides for greater structural rigidity and reduced deflection of the stationary front wall.

Another object of the present invention is to provide a headbox having a stationary front wall with a new and improved arrangement for moving both the upstream and downstream edges of an upper lip of a stock discharge nozzle, along respective paths with a horizontal component away from and back toward the headbox, in addition to an arrangement for pivoting the donwstream edge of the upper lip about a horizontal axis through the upstream edge of the upper lip.

Another object of the present invention is to provide a headbox having a stationary front wall with a new and improved arrangement for moving both the upstream and downstream edges of an upper lip of a stock discharge nozzle, along respective paths with a horizontal component away from and back toward the headbox, in addition to providing the upper lip with a transverse hinge intermediate the ends thereof and an arrangement for raising and lowering the hinge relative to the upstream and downstream edges of the upper lip.

The improvement according to the present invention comprises providing a cylindrical bearing supported by headbox front wall structure for rotation about a horizontal axis central to the cylindrical bearing. The upstream edge of an upper lip of a stock discharge nozzle is journaled in a socket defined in the outer periphery of the cylindrical bearing for supporting the upstream edge of the upper lip for pivotal movement of the upper lip relative to the socket and cylindrical bearing. A linkage is connected to the cylindrical bearing for rotating the

cylindrical bearing about its central axis and moving the upper lip with the upstream and downstream edges thereof moving along respective paths each having a horizontal component. A preferred embodiment also has a plurality of generally vertical slice opening adjusting rods connected to the upper lip close to the downstream edge for raising and lowering the downstream edge to pivot the upper lip about an axis central of the socket in the cylindrical bearing. A preferred embodiment of the present invention may also include an upper lip comprising two parts connected by a hinge parallel to the cylindrical bearing and intermediate the upstream and downstream edges of the upper lip and with a jack assembly connected to the hinge for raising and lowering the hinge and adjacent portions of the lip parts to adjust the internal configuration of the stock discharging nozzle.

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

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of one embodiment of a headbox according to the present invention;

FIG. 2 is a view in perspective and in section, of the headbox shown in FIG. 1;

FIG. 3 is a view in perspective and in section, showing another embodiment of a headbox according to the present invention; and

FIG. 4 is a fragmentary side elevation showing a third embodiment of a headbox according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a head box **10** is shown comprising a vertical front wall assembly **11**, a vertical rear wall assembly **12**, a horizontal structure defining a box floor **13**, and a horizontal structure defining a box top **14**. A structure defining a pulp inlet chamber **15** communicates through the rear wall assembly **12** and a slice assembly **16** projects outwardy from the front wall assembly **11** to define a tapered nozzle passage **17** that communicates through the front wall assembly **11** with a central flow passage **18** defined between the floor **13** and top **14** and the inlet chamber **15**. The central flow passage extends from the rear wall assembly **12** to the front wall assembly **11**.

The headbox **10** is provided with a stock entrance assembly **20** which includes a manifold **21** with a plurality of tubes **22** connecting manifold **21** to the inlet chamber **15**. Referring to FIG. 2 the slice assembly **16** includes an upper slice lip **25** connected to the front wall assembly **11** at the level of the top of flow passage **18** in a manner that will appear from the description of the present invention to follow. A lower lip **26** is provided and connected to an apron board **27** which is part of the front wall assembly **11** at the level of the bottom of flow passage **18**. The upper slice lip **25** has a downstream edge **28** which cooperates with lower lip **26** to define a slice opening **29** for discharging dilute pulp stock onto a Fourdrinier web forming wire **30** looped over a breast roll **31** shown in FIG. 1.

Referring again to FIG. 2, a journal box **32** is shown comprising pieces **33, 34** having horizontally extending and vertically spaced edges **35, 36**. The pieces **33, 34** define a journal box cavity **37** and an opening between the journal edges **35, 36** facing downwardly therefrom and away from the front wall **11**. A cylindrical bearing **40** is journaled in the journal box **32**. The cylindrical bearing **40** is rotatable about a horizontal axis **41** central to the cylindrical bearing **40**. The axis **41** about which the cylindrical bearing can rotate is held by the journal box **32** in a position fixed in space and therefore at a fixed distance from the front wall assembly **11**. The bearing **40** defines a horizontally extending socket **42** in the outer periphery thereof positioned to open through the journal box opening between the lips **35, 36**.

A horizontally extending upstream edge **45** of the upper slice lip **25**, is provided which in vertical cross section is rounded with a diameter greater than the thickness of an adjacent portion of the upper lip **25**. A horizontally extending clamp bar **46** is connected to the cylindrical bearing **40** above the upstream edge **45** of the upper slice lip **25** for holding the rounded upstream edge **45** in the socket **42** for pivotal movement of the upper slice lip **25** relative to the socket **42**.

Referring again to FIG. 1, an operating linkage **48** is provided for rotating the cylindrical bearing **40** about its central axis **41**. The operating linkage **48** includes a crank arm **49** rigidly secured to the cylindrical bearing **40**, a movable rod **50** pivotally connected on one end thereof, by a pivot pin **51**, to crank arm **49**, and a drive mechanism **52** that engages the end of rod **50** remote of the pin **51**, to move rod **50** toward and back from the slice assembly **16** end of the headbox **10**. The drive mechanism **52** may be of any suitable type, for example a reversible motor **53** may turn shaft **54** with a pinion gear (not shown) on shaft **54** engaging a rack gear (not shown) on rod **50**, to apply linear movement to rod **50** upon rotary movement of shaft **54**. Linear movement of rod **50** to turn crank arm **49** requires that the drive mechanism **52** be mounted for pivotal movement in a vertical plane and therefore drive mechanism **52** may be pivotally mounted on a bracket **55** by a pin **56**.

With further reference to FIG. 1, a plurality of generally vertical adjusting rods **59** are shown that are connected to the upper slice lip **25** by a pivotal connection **60** adjacent the downstream edge **28**. Each of the rods **59** is carried by a bushing **61** which in turn is carried by support arms **62** connected to shaft **63**. The shaft **63** is journaled in a journal box **64** connected to the front wall assembly **11** above the slice assembly **16**. An operating linkage **65** with a drive mechanism **66** is provided to rotate shaft **63** about an axis **67** central of shaft **63**. The operating linkage **65** and drive mechanism **66** may be constructed in the same manner as has been described for the operating linkage **48** and drive mechanism **52**. The drive mechanism **66** and linkage **65** are similarly operative to rotate shaft **63** to raise and lower rods **59** to adjust slice opening **29**.

Another embodiment of the present invention is shown in FIG. 3, which is similar in all respects to the headbox shown in FIGS. 1 and 2, except that the headbox of FIG. 3 is provided with an upper slice lip **25*a*** comprising two parts **70, 71**. The upper slice lip parts **70, 71** are connected by a hinge **72** parallel to the cylindrical bearing **40** and intermediate the upstream edge **45** and the downstream edge **28** of the upper lip **25*a***. A jack assembly **73** is connected to the part **70** of the upper slice lip **25*a*** above and adjacent the hinge **72**. The jack assembly **73** comprises a drive mechanism **74** which also may be constructed in the same manner as has been described for the drive mechanism **52** shown in FIG. 1. The drive mechanism **74** is shown in FIG. 3 as having a movable rod **75** and the drive mechanism is connected to the front wall assembly **11** and supported thereby with the rod **75** in a vertical position. The vertical rod **75** is connected to a horizontal shaft **76** journaled in a box **77** which is carried by shaft **76** and rod **75** to be pivotal about an axis **78** central of the shaft **76**. The box **77** comprises an upper part **79** through which the rod **75** projects, and a lower part **80** having a rounded lower edge **81**. The lower edge **81** is fitted in a socket **82** defined in the top of the part **70** and a clamp bar **83** connected to the top of the part **70** holds the edge **81** in socket **82**.

A third embodiment of the present invention is shown in FIG. 4. In this embodiment the front wall **11** encloses a chamber **18*a*** as is provided in pressurized and vacuum headboxes such as shown for example in U.S. Pat. 3,515,-

635. As shown in FIG. 4, cylindrical bearing **40** is depending from the top of a front wall discharge opening **19** with the bearing axis **41** between vertical planes defined by a chamber side **11***a* and a slice side **11***b* of front wall **11**. A portion **33** of the front wall **11** and a horizontally extending member **34**, having horizontally extending and spaced edges **35**, **36**, define a journal box **32** with an opening facing downwardly therefrom. The cylindrical bearing **40** is journaled in the box **32** with the socket **42** being both below and on the chamber side **11***a* of axis **41**. The upstream edge **45** of part **70** of the upper slice lip **25***a* is held for pivotal movement in socket **42** and bearing **40** may be rotated about axis **41** as described with reference to the other embodiments. In this embodiment a distributing roll **90** may be provided in close spaced relation to bearing **40** as shown.

The operation of the apparatus shown in FIGS. 1 and 2 will now be described. Dilute paper stock enters manifold **21** and flows upwardly through the tubes **22** to the inlet chamber **15**. From the inlet chamber **15** the stock flows through the flow passage **18** to the tapered nozzle passage **17** and out slice opening **29** to be deposited on the wire **30** passing over breast roll **31**. The position of the upper slice lip **25** is adjusted by the operation of the linkages **48**, **65**. The linkage **48** may be operated by the drive mechanism **52** applying movement to the rod **50** toward and back away from the slice opening **29** end of the headbox **10**. Such movement of rod **50** turns crank arm **49** and rotates the cylindrical bearing **40** about axis **41**. Rotation of bearing **40** moves the upstream edge **45** of the upper slice lip **25** about axis **41** and the downstream edge **28** about the pivotal connection **60**, both along paths having a vertical component and a horizontal component of movement in a vertical plane parallel to the centerline of the machine. The linkage **65** may also be operated to pivot the upper slice lip about the upstream edge to provide vertical movement of the downstream edge **28** with an additional component in a vertical plane parallel to the centerline of the machine. The axis **41** being fixed in space and central of a cylindrical bearing greatly simplifies designing the structure with axis **41** close to front wall **11** for rigid though adjustable support of the upstream edge **45** of the upper slice lip **25**, and provides for smooth very small and accurate incremental adjustment of the position of edge **45** without interrupting stock flow and with greatly minimized possibilities for unwanted deflection of the upper lip **25**.

The operation of the embodiment shown in FIG. 3 additionally provides for raising and lowering of the hinge **72** and adjacent portions of the parts **70** and **71** to adjust the internal configuration of the tapered discharge nozzle passage **17**. Such adjustment is provided by the drive mechanism **74** lifting and lowering rod **75** and box **77**. Lifting and lowering box **77**, which is pivotal about axis **78**, raises and lowers hinge **72** with part **70** pivoting about its upstream edge **45** and part **71** pivoting about the pivotal connection **60**.

The operation of the embodiment shown in FIG. 4, from the position shown with solid lines to the position indicated by broken lines, or any setting intermediate those positions, is as has been described.

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.

I claim:

1. In a headbox for a papermaking machine having a stationary front wall assembly defining a pulp stock discharge opening, a slice assembly arranged and connected to the front wall to project outwardly thereform to define a tapered discharge nozzle passage away from the front wall discharge opening, and with the slice assembly comprising an upper lip and a lower lip, the improvement comprising:

(a) a cylindrical bearing journaled in the front wall assembly to rotate about a stationary horizontal axis central to the cylindrical bearing with the bearing axis being a fixed distance from the slice assembly side of the front wall assembly and above the front wall discharge opening;

(b) a horizontally extending socket defined in the outer periphery of the cylindrical bearing;

(c) a horizontally extending upstream edge of the upper slice lip journaled in the socket for rotary movement of the upper slice lip relative to the socket and cylindrical bearing; and

(d) an operating linkage connected to the cylindrical bearing for rotating the cylindrical bearing about its central axis to move the upstream edge of the upper slice lip relative to the front wall along a path having horizontal components away from and back toward the front wall for adjusting the tapered discharge passage.

2. In a headbox according to claim **1**, a journal box connected to the front wall assembly above the front wall discharge opening, the journal box having a pair of horizontally extending and vertically spaced edges defining a journal box opening facing downwardly therefrom and away from the front wall, the cylindrical bearing journaled in the journal box with the socket between the journal box edges to carry the upstream edge of the upper slice lip at a level below the central axis of the cylindrical bearing.

3. In a headbox according to claim **2**, the upstream edge of the upper lip of the slice assembly is, in vertical cross section, rounded with a diameter greater than the thickness of an adjacent portion of the upper slice lip, and a horizontally extending clamp bar is connected to the cylindrical bearing above the upstream edge of the upper slice lip for holding the rounded upstream edge of the upper slice lip in the socket for pivotal movement of the upper slice lip relative to the socket.

4. In a headbox according to claim **1**, a plurality of generally vertical adjusting rods connected to the upper slice lip adjacent the downstream edge thereof for raising and lowering the downstream edge of the upper slice lip to pivot the upper slice lip about an axis central to the socket in the cylindrical bearing.

5. In a headbox according to claim **1**, the upper slice lip comprising two parts connected by a hinge parallel to the cylindrical bearing and intermediate the upstream and downstream edges of the upper slice lip, and a jack assembly supported by the front wall assembly above the upper slice lip with the jack assembly connected to the hinge and operative to raise and lower the hinge and adjacent portions of the parts of the upper slice lip to adjust the internal configuration of the tapered discharge nozzle passage.

6. In a headbox for a papermaking machine having a stock chamber enclosed in part by a stationary front wall assembly defining a pulp stock discharge opening, a slice assembly arranged and connected to the front wall to project outwardly therefrom to define a discharge nozzle passage away from the front wall discharge opening, and with the slice assembly comprising an upper lip and a lower lip, the improvement comprising:

(a) a bearing having a cylindrical bearing surface journaled in the front wall assembly to rotate about a stationary horizontal axis central to the cylindrical bearing surface with the bearing axis being in a fixed position relative to the front wall assembly and in a horizontal plane above the lower lip;

(b) a horizontally extending socket defined in the outer periphery of the bearing;

(c) a horizontally extending upstream edge of the upper slice lip journaled in the socket for rotary movement of the upper slice lip relative to the socket and bearing; and

(d) an operating linkage connected to the bearing for rotating the bearing about its central axis to move the upstream edge of the upper slice lip relative to the front wall along a path having horizontal components away from the back toward the front wall for adjusting the discharge passage.

7. In a headbox according to claim 6, the bearing being journaled in the front wall assembly to be depending from the top of the front wall discharge opening and with the bearing axis between vertical planes defined by the chamber side and the slice side of the front wall assembly.

8. In a headbox according to claim 7 the socket in which the upstream edge of the upper slice lip pivots is both below and on the chamber side of the axis about which the bearing rotates.

9. In a headbox according to claim 6, the bearing being journaled in the front wall assembly by means of a journal box defined in the front wall assembly at the top of the front wall discharge opening, the journal box having a pair of horizontally extending and spaced edges defining a journal box opening facing downwardly therefrom, the bearing journaled in the journal box with the socket between the journal box edges to carry the upstream edge of the upper slice lip at a level below the central axis of the bearing.

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