Aug. 26, 1969 D. R. CURTIS 3,463,701

REMOTE CONTROLLED HEADBOX SLICE

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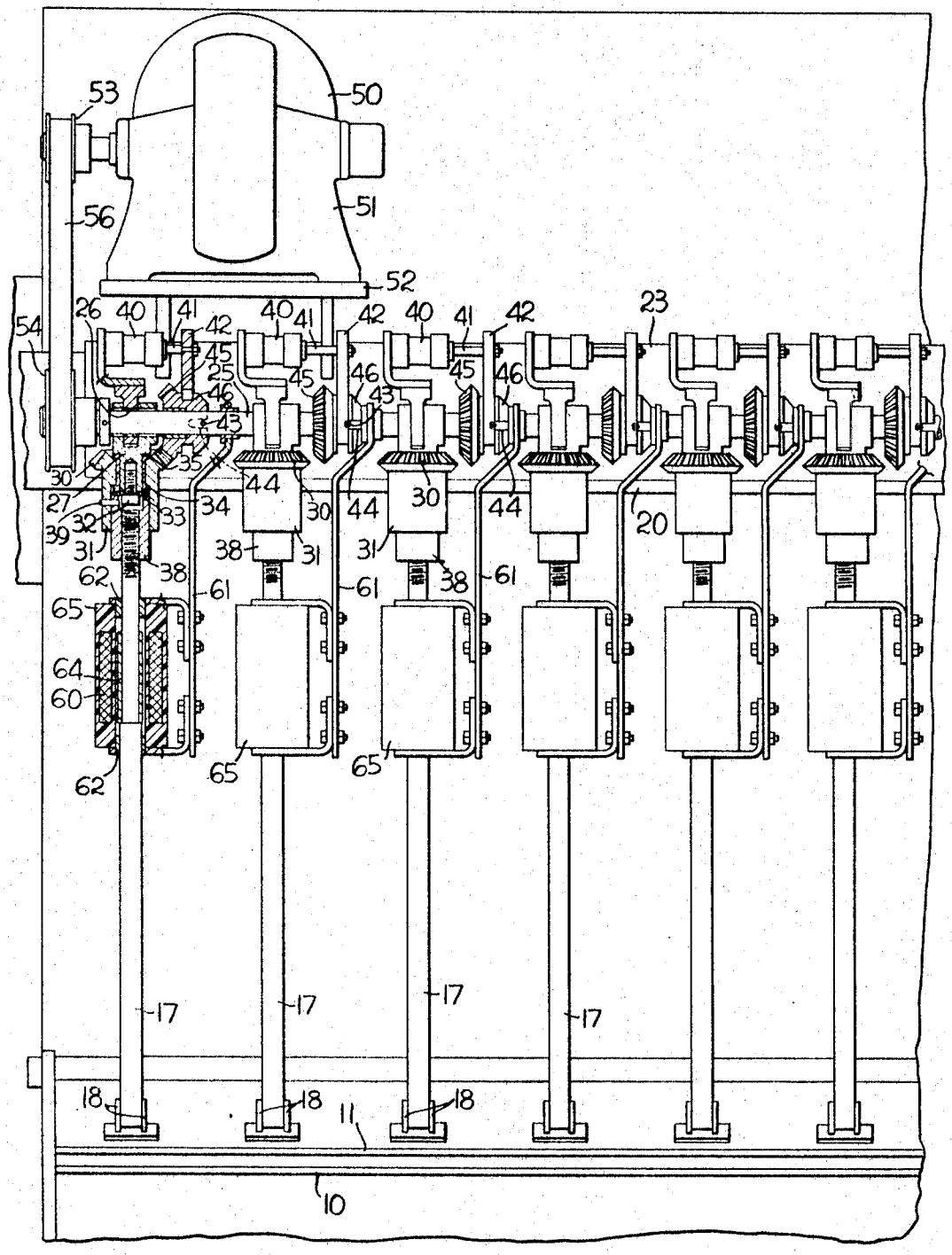


Fig. 1

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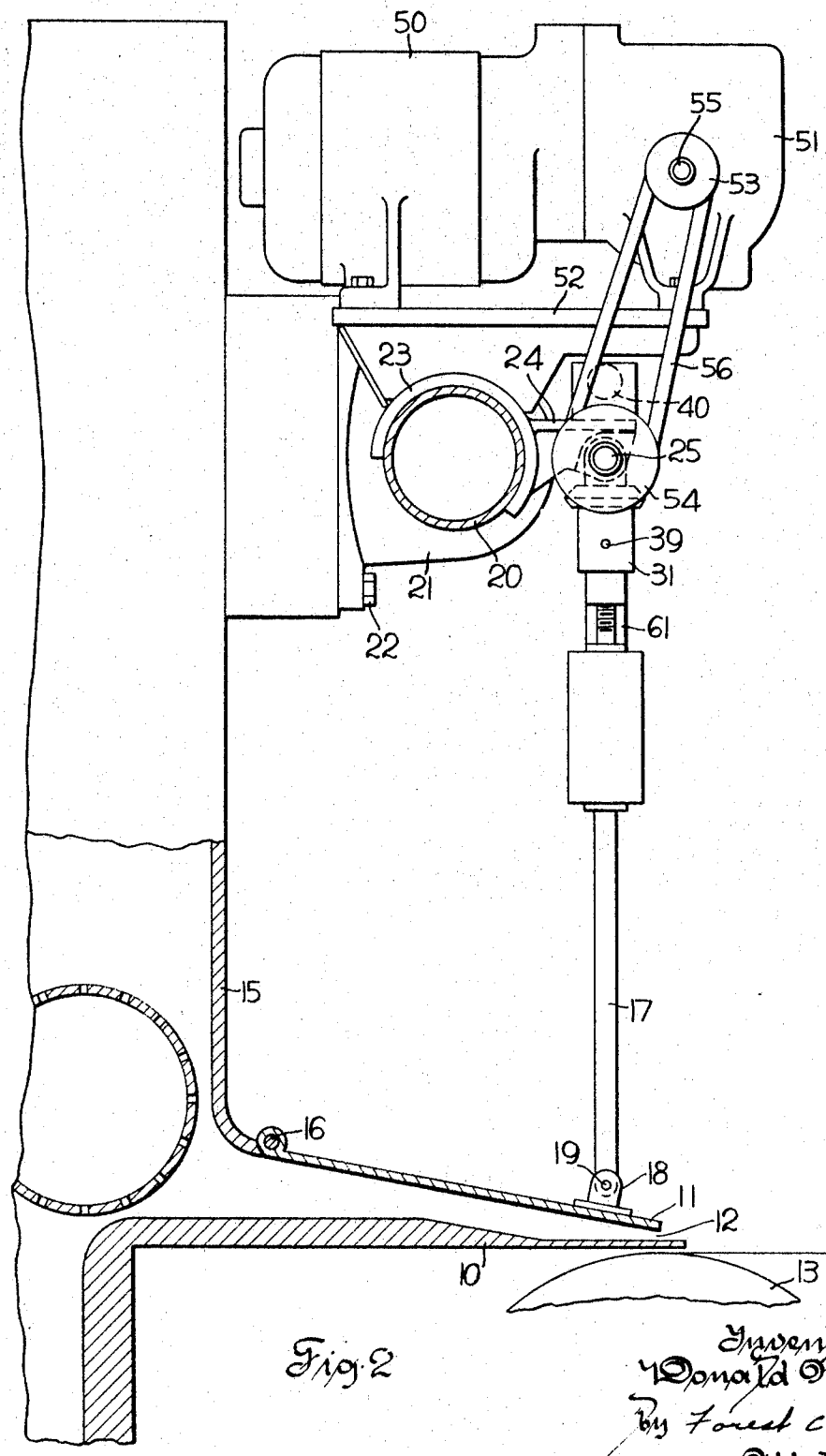


Fig. 2

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REMOTE CONTROLLED HEADBOX SLICE

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U.S. Cl. 162—347 4 Claims

ABSTRACT OF THE DISCLOSURE

A remotely controlled headbox slice for a Fourdrinier headbox having a plurality of independently adjustable and selectively operable micro-rods supporting the top lip of said slice and having position sensors adjacent the micro-rods to indicate to the operator the relative position of said rods.

This invention relates generally to slice controls for papermaking machinery. More specifically, this invention relates to a remote controlled, mechanical, micro-rod drive system for the top lip of a headbox slice on a Fourdrinier papermaking machine.

The ability to adjust and accurately control the headbox slice on a Fourdrinier papermaking machine is of great significance to the successful operation of the machine. The slice must not only be capable of operating at various positions of adjustment to vary the wet web thickness, but the precise contour of the slice top lip must be subject to fine adjustment during operation to keep the flow smooth, uniform and free from eddies. Thus, the slice not only controls the thickness of the paper product, but the fine adjustments serve to assure a closer control of paper quality.

In the more conventional Fourdrinier machines, the slice is controlled by providing an adjustable top lip which may be raised or lowered by appropriate adjustment of a plurality of micro-rods spaced across the width of the headbox. That is, the free end of the top lip is suspended by a plurality of uniformly spaced micro-rods each provided with an individual hand wheel which may be turned to raise or lower each individual micro-rod to effect fine adjustment of the top lip. A means is usually provided whereby all micro-rods may be activated in unison for major adjustments. In order to make fine adjustments, the machine operator must climb up on the machine over the slice and adjust each rod individually by turning the hand wheel therefor.

This invention is predicated upon my development of a mechanically driven top lip of a headbox slice wherein any combination of micro-rods can be driven remotely by a single motor. Specifically, this invention provides for a plurality of gears slidably keyed onto a single motor driven shaft disposed transverse to the micro-rods, with each gear selectively capable of actuating one micro-rod upon rotation of the shaft. Position sensors may also be associated with each micro-rod to provide the operator with information as to the relative position of each micro-rod.

It is a primary object of this invention therefore, to provide a simple remotely controlled headbox slice for a Fourdrinier papermaking machine.

It is another primary object of this invention to provide a headbox slice for a Fourdrinier machine wherein the top lip is remotely controlled by a single motor through the selective coaction of motor driven gears on a plurality of micro-rods spaced along the forward edge of the top lip.

It is a further primary object of this invention to provide a remote control for a headbox slice top lip wherein the remote operation is facilitated by position sensors which remotely indicate the relative position of the top lip micro-rods.

These and other objects and advantages are fulfilled by this invention as will become apparent from the following detailed description especially when considered in conjunction with the accompanying drawings of which:

FIG. 1 is a partial front elevation of the top lip, micro-rods, and micro-rod control mechanism illustrating one embodiment of this invention, wherein the extreme left micro-rod drive mechanism is shown in cross section; and

FIG. 2 is a side elevation of the apparatus shown in FIG. 1, wherein the headbox slice portion is shown in cross section.

Since the Fourdrinier machine is old and well known in the art, the drawings are limited to only those features that are necessary for a complete understanding of this invention.

Referring to the drawings, the headbox slice according to one embodiment of this invention comprises a bottom slice lip **10** and a top slice lip **11** relatively spaced to provide the horizontal slice opening **12** which is disposed immediately above and parallel to the breast roll **13** and wire **14**. As in most conventional Fourdrinier machines, the bottom lip **10** is a fixed apron extension of the lower headbox wall. The back side of the top lip **11** is hinged to the headbox wall **15** by any means such as hinge pin **16**, while the forward edge is suspended from a plurality of micro-rods **17** pivotally secured thereto by brackets **18** and pins **19**.

As in some of the more conventional Fourdrinier machines, a horizontally disposed, cylindrical, rotatable nozzle beam **20** serves, in part, to indirectly support the upper ends of the micro-rods **17**. Specifically, the nozzle beam **20** is secured horizontally to the headbox wall **15** by any means such as a plurality of supports **21** and bolts **22** (FIG. 2). A plurality of nozzle beam brackets **23**, each having an arm **24** extending therefrom, are secured to the nozzle beam **20** to rotatably support a cross-shaft **25** parallel to and forward of the nozzle beam **20**. The cross-shaft **25** is rotatably fitted within bearings **26** through arms **24**. A pivot pin **27** is yoked about each arm **24** on bracket **23** and therefore hangs pivotally suspended from cross-shaft **25**. A miter gear **30**, having a tubular extension **31**, is rotatably fitted over the cylindrical lower portion of each pivot pin **27**, and hangs suspended therefrom securing the threaded upper end of a micro-rod **17**, maintaining the micro-rod in a substantially vertical position.

Although the detail of the miter gear linkage is not critical to this invention, it may be noted that in the embodiment shown, the base of each pivot pin **27** is drilled and tapped to receive a bolt **32** which secures a washer **33** against the base of the pivot pin **27**. The washer **33** accordingly provides a lip to support the flanged bushings **34** and **35** onto the cylindrical lower portion of each pivot pin **27**. The miter gear **30** is therefore rotatably secured to the pivot pin **27** by the flanged bushings **34** and **35**.

A tubular screw nut **38** is secured within the tubular extension **31** on miter gear **30** and rigidly secured by any means such as pin **39** (FIG. 2). The upper end of each micro-rod **17** is threaded into the tubular screw nut **38**. Therefore, rotation of any miter gear **30** will cause the associated micro-rod **17** to be pulled up or down, depending upon direction of rotation, by the screw action of tubular screw nut **38**.

An energizer **40**, such as a solenoid or air cylinder, is rigidly secured to each arm **24** on each nozzle beam bracket **23** so that the reciprocating shaft **41** is parallel to the cross-shaft **25**. A shifting fork collar **42** is bolted to the

outer tip of the reciprocating shaft **41**. The fork portion of the shifting fork collar **42** engages a second miter gear **45** having a flange **46** which is slidably keyed onto the cross-shaft **25** adjacent to each pivot pin **27**. As shown, each key comprises a pin **43** passing diametrically through the cross-shaft **25** which slidably engages grooves **44** on the back side of a miter gear **45**. Each second miter gear **45** may or may not be in meshing engagement with the associated first miter gear **30** depending upon the action of the energizer **40**. That is to say, a pulling action of the energizer **40** on the reciprocating shaft **41** will pull the shifting fork collar **42** and second miter gear **45** into a meshing engagement with the first miter gear **30**. Conversely, the two miter gears **30** and **45** will not be in a meshing engagement upon a pushing action of the energizer **40**.

A low speed motor **50**, coupled to a low r.p.m. gear box **51**, is rigidly secured to a motor stand **52** which is in turn rigidly secured to the upper side of nozzle beam **20**. A pair of pulleys **53** and **54** are respectively secured and relatively aligned on the gear box drive shaft **55** and the cross-shaft **25**. A belt **56** is then provided to interconnect the two pulleys **53** and **54** so that the motor may be activated to rotate the cross-shaft **25** and therefore the second miter gears **45** keyed thereto.

Since the above described equipment will permit remote control of the headbox slice top lip, it is also desirable to provide a position indicator for each micro-rod so that the relative position of each micro-rod can be read at the remote position where the slice is controlled. This can be done by providing a position sensing coil or transformer **60** concentrically about a magnetic sleeve **64** tightly secured to each micro-rod **17**. As shown, the transformer **60** is encased within a housing **65** which is secured to a bracket **61** which hangs suspended from the cross-shaft **25**. The transformer housings **65** are provided with bushings **62** which will permit the micro-rods **17** to freely slide therewithin. Since such position sensors are well known, they will not be further detailed here.

As in more conventional Fourdrinier machines, the nozzle beam **20** is rotatable so that major adjustments may be made. Rotation of the nozzle beam **20** will cause the entire micro-rod and micro-rod drive assembly to be pivoted about the axis of the nozzle beam **20** thus activating all micro-rods in unison.

At a remote control panel (not shown) the entire mechanism described above can be controlled. This control panel should have individual means for activating each energizer **40** in either direction, and means for activating the motor **50** and gear box **51** in either direction. If position sensors are provided, the control panel will also be provided with signal means for indicating the relative position of each micro-rod **17** as relayed by the transformer **60**.

In operation then, the top lip **11** of the headbox slice can be controlled remotely. If the operator desires to raise any of the micro-rods **17**, he can activate the appropriate energizers **40** to bring the selected miter gears **30** and **45** into a meshing engagement. The motor **50** is then activated to raise these micro-rods **17** to the desired position. To lower selected micro-rods **17**, the same procedure is followed, except that the gearbox **51** is set so that it will rotate the cross-shaft **25** in the reverse direction.

To make major adjustments in the top lip **10** without changing the contour thereof, nozzle beam **20** may be rotated to lift or lower all micro-rods in unison. Thus, the entire drive and cross-shaft assembly is pivoted about the axis of the nozzle beam **20**.

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

1. A remotely controlled headbox slice for a Fourdrinier papermaking machine comprising a top slice lip pivotally secured to said headbox and relatively spaced above a bottom slice lip to form therebetween a horizontal slice opening from said headbox, a plurality of rotatable micro-rods arranged in horizontally spaced vertical planes for supporting the forward edge of said top slice lip, said micro-rods being movable in said vertical planes upon rotation thereof to raise and lower portions of said top lip connected thereto, each of said rods having a first miter gear mounted on its top end, and a bracket pivotally engaging said top slice lip at its other end, a rotatably mounted cross-shaft disposed transverse to the upper ends of said micro-rods, a plurality of spaced apart second miter gears mounted on said shaft for rotation therewith, each of said second miter gears being axially slidable along said shaft and positioned adjacent an associated said first miter gear, means for individually sliding selected said second miter gears into and out of meshing engagement with their associated said first miter gears, and means for rotating said cross-shaft and said second miter gears thereon so that when selected of said first and second miter gears are in meshing engagement said first miter gears will be caused to rotate its micro-rod and move said top lip slice.

2. The headbox slice of claim **1** in which the means for sliding said second miter gears along said shaft are air cylinders.

3. The headbox slice of claim **1** in which the means for rotating said cross-shaft is an electric motor controlled from a remote location.

4. The headbox slice of claim **3** further comprising a position sensor for each micro-rod for indicating to said remote location the relative position of each micro-rod.

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