

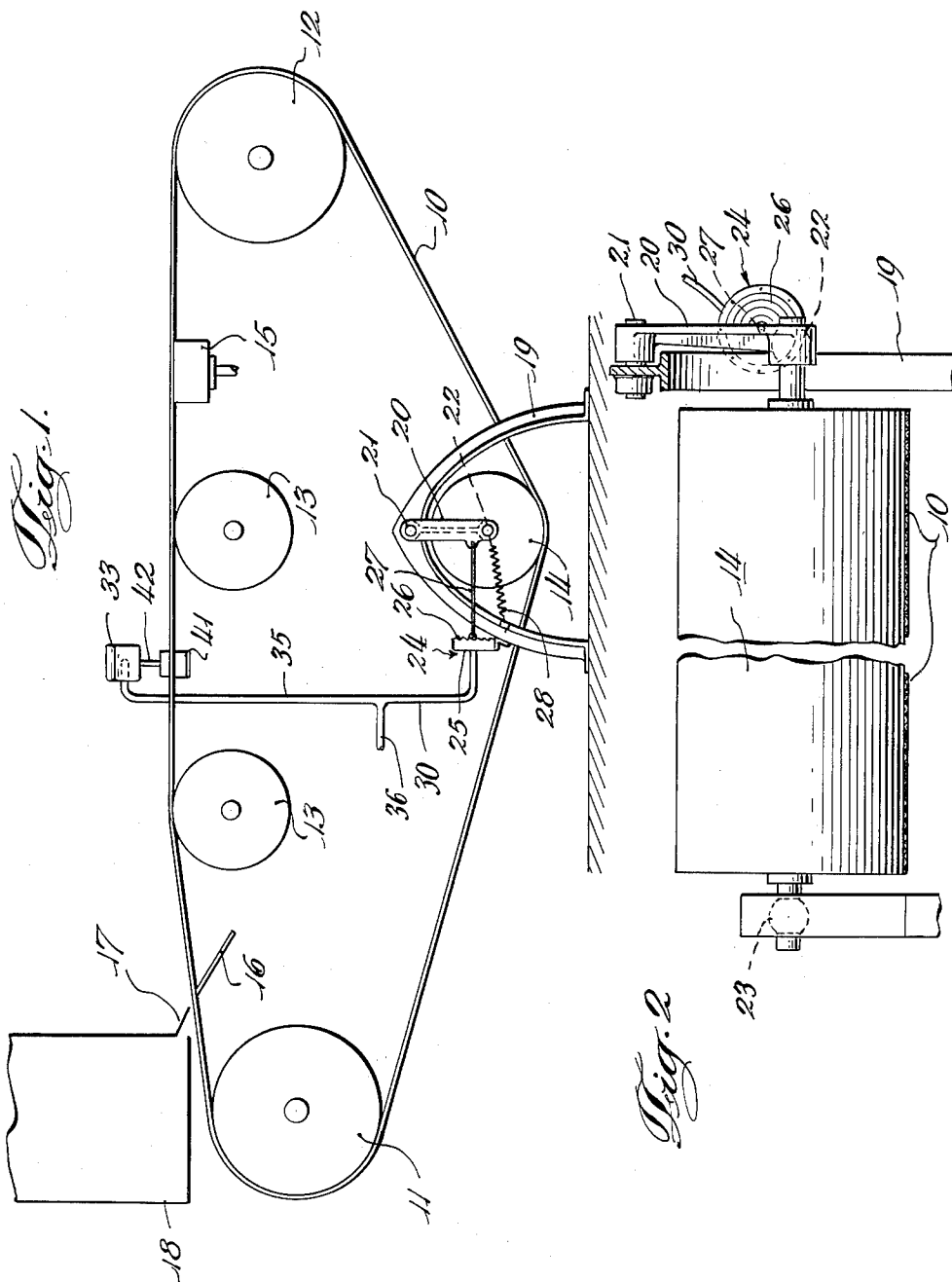
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R. J. MADDEN ET AL
PAPERMAKING MACHINE

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2 Sheets-Sheet 1



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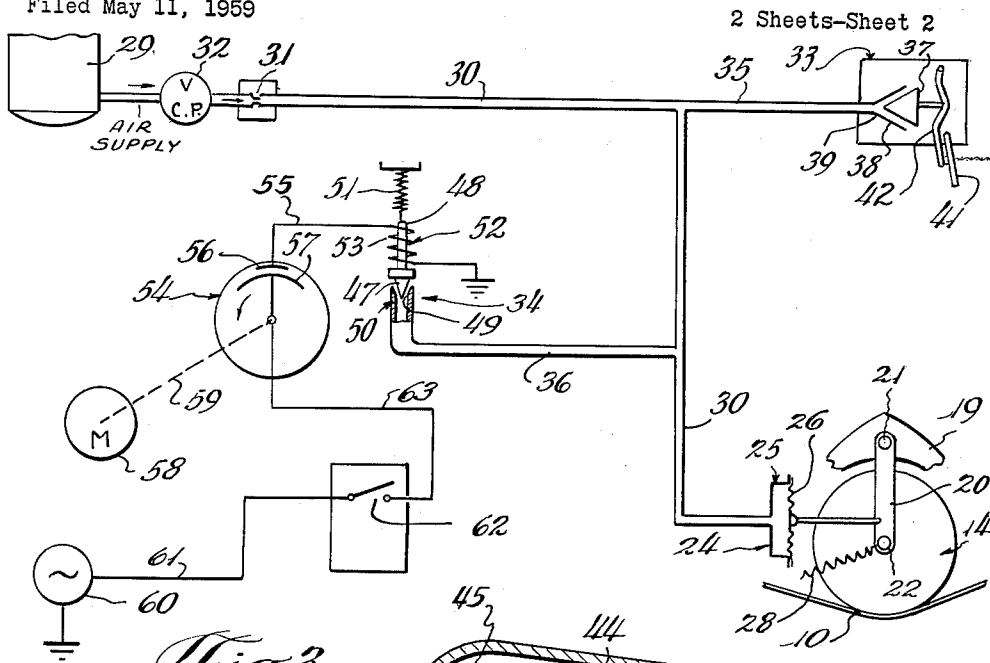


Fig. 3.

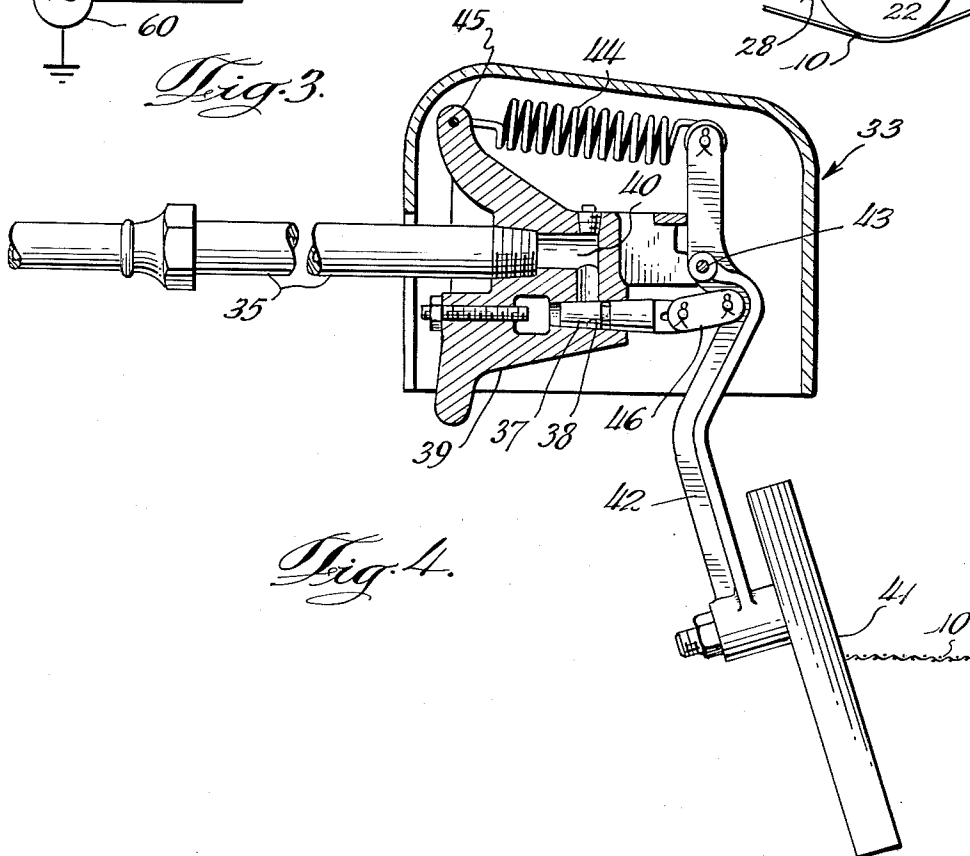


Fig. 4.

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PAPERMAKING MACHINE

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Our invention relates to papermaking machines of the Fourdrinier type and more particularly to mechanisms for controlling the moving wire of such machines.

Fourdrinier type papermaking machines generally comprise a loop of fine mesh wire on which a slurry of paper stock is deposited, the wire being disposed about a plurality of rolls and travelling about the rolls at high speed. A water doctor blade may be provided beneath and in close contact with the wire at a station prior to a first table roll and subsequent to the station at which the slurry of paper stock is deposited onto the wire. The water doctor blade functions to scrape off water that has passed through the wire from the slurry immediately after its deposit on the wire. One or more vacuum boxes normally follow a second table roll, and all function to remove more water from the web.

Unless certain corrective mechanism is provided, the wire tends to drift laterally in one direction or the other off of the rolls. Such preventive mechanism may comprise a paddle operated bleed valve positioned by the edge of the wire and pneumatically connected with a power unit, which acts to position one end of a movable guide roll in such manner that it will always return the wire to some predetermined position on the rolls.

It has been found that, with such a mechanism maintaining the wire travel in a certain path around the rolls, the edge of the water doctor blade and to a lesser degree the top of the vacuum boxes and the machine rolls become grooved. Though the thin edge of the water doctor blade is particularly prone to grooving at the points of contact with the edges of the Fourdrinier wire, the water doctor blade is also minutely grooved throughout its length by the small knuckles of the warp wires of the Fourdrinier wire. The wire tends to have very slight lateral movements, and these minute grooves hinder such movements and sometimes cause folds to occur in the wire; while the deeper wire edge grooves provoke curling or folding, and eventually, fraying of the wire edge.

It is therefore an object of the present invention to prevent grooving of the water doctor, vacuum boxes, and other paper machine equipment, along the path in which the wire is normally guided and thus avoid folding in the wire and avoid curling and excess wear of the edge of the wire during operation.

More particularly, it is an object of the invention to provide improved mechanism in connection with such papermaking machines for causing the wire to periodically move laterally on the rolls for preventing such grooves.

Yet another object is to provide improved mechanism to initiate periodic lateral movements of the wire and which is automatically actuated and is a simple and inexpensive addition to available wire guide equipment. It is contemplated that the normal wire guide control system will be allowed to govern the lateral movement of the wire except during such periodic lateral movements.

Briefly, our improved mechanism for periodically varying the lateral position of the Fourdrinier wire may comprise, in a preferred form, an electrical synchronous motor driving a rotary switch which intermittently actuates an electromagnetically operated bleed valve controlling a pneumatically operated wire guide system.

The invention consists of the novel constructions, arrangements and devices to be hereinafter described and

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claimed for carrying out the above stated objects, and such other objects, as will be apparent from the following description of a preferred form of the invention, illustrated with reference to the accompanying drawings, wherein:

FIGURE 1 is a diagrammatic elevational view of a papermaking machine including a Fourdrinier wire travelling around a plurality of rolls;

FIGURE 2 is a side elevational view on an enlarged scale of one of the rolls, showing mechanism for moving one end of the roll;

FIGURE 3 is a diagrammatic illustration of an air pressure control system for controlling the lateral position of the wire on the rolls, including a paddle operated bleed valve and an apparatus for intermittently bleeding air from the control system; and

FIGURE 4 is a sectional view of the paddle operated bleed valve.

Like characters of reference designate like parts in the several views.

Referring now to FIGURES 1 and 2, the illustrated papermaking machine includes an endless belt in the form of a Fourdrinier wire 10 positioned about a breast roll 11, a couch roll 12, table rolls 13 and an adjustable guide roll 14. A vacuum box 15 and a water doctor blade 16 are positioned beneath the wire and in contact with it. A slice 17 connected with a headbox or pressure feed system 18 are positioned above the wire 10.

The guide roll 14 is movably adjustable on one end, being supported by means of a support frame 19, a link 20 pivotally connected to the frame by means of a pin 21, and a spherical bearing 22 rotatably mounting the roll 14 with respect to the link 20. The opposite end of the roll 14 is supported by means of a second spherical bearing 23.

A power unit 24 is connected to the link 20 for the purpose of moving the end of the roll 14. The power unit 24 comprises a casing 25 supporting a flexible diaphragm 26 which is connected by means of a pressure rod 27 with the link 20. A tension spring 28 is provided between the support frame 19 and the link 20.

The power unit 24 is actuated by means of an air pressure system including an air supply 29 (see FIGURE 3). The power unit 24 is connected by means of a conduit 30 with the air supply 29. A restriction 31 and a constant pressure regulator 32 are connected in series in the conduit 30.

A first bleed valve 33 and a second bleed valve 34 are arranged in parallel to the conduit 30. The bleed valve 33 is connected by means of a branch conduit 35 to the conduit 30, and the bleed valve 34 is connected by means of a branch conduit 36 to the conduit 30.

The bleed valve 33 comprises a tapered valve plunger 37 disposed within a tapered cavity 38 provided in a valve housing 39. The valve housing 39 is connected to the branch conduit 35, and the tapered cavity 38 is connected by a passage 40 within the valve housing 39 to the branch conduit 35. A paddle 41 is fixed on an arm 42 that is pivotally supported with respect to the valve housing 39 by means of a connection 43. The paddle 41 is in contact with an edge of the wire 10, and a tension spring 44 is attached to the free end of the arm 42 and an arm portion 45 of the housing 39 for holding the paddle 41 tensioned against the wire 10. A link 46 is provided between the arm 42 and the tapered valve plunger 37.

The bleed valve 34 comprises a tapered plunger 47 carried by an armature 48. The tapered plunger 47 is adapted to fit in a tapered aperture 49 provided in a valve part 50 which is connected to the branch conduit 36, and the tapered plunger 47 is held in the closed position by a compression spring 51.

An electromagnet 52 is provided for actuating the bleed

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valve 34 and comprises an electrical winding 53, surrounding the armature 48. A switch 54, which is connected to the electromagnet 52 by an electrical lead 55, comprises a fixed contact 56 and a movable contact 57 adapted to periodically make contact with the fixed contact 56. An electrical synchronous motor 58 is connected by means of a shaft 59 with the movable contact 57.

A source of alternating current 60 is connected through an electrical lead 61, a manually operated switch 62 and an electrical lead 63 with the movable contact 57.

In the operation of the Fourdrinier papermaking machine described above, the Fourdrinier wire 10 passes over the rolls 11, 12, 13 and 14, and one or more of the rolls is rotatably driven by any suitable driving mechanism (not shown) to provide such wire movement. Slurried stock is contained by the headbox 18, which may be of any conventional type, and the stock issues out of the slice 17 onto the wire 10. The water doctor blade 16 is disposed within the wire 10 and in close contact with its inner surface for the purpose of removing the water which penetrates the wire 10 immediately after the slice 17 and deflecting this water downwardly so that it is not carried back up to the lower side of the Fourdrinier wire 10 by the immediately succeeding table roll 13. The first and second table rolls 13 are disposed within the wire 10 so as to give the wire a substantially horizontal travel through this section of its route. These table rolls 13 are followed by the suction box 15, and all function to draw water from the web which has been formed on the Fourdrinier wire 10. The couch roll 12, from whence the dewatered web is transferred to a press section (not shown) where more water is expressed from the web, constitutes a direction changing roll permitting the continuous wire 10 to return by means of a lower pass to the breast roll 11.

The guide roll 14 is in contact with the lower pass of the wire 10 and holds the wire in a looped configuration. As previously described, the right end of the guide roll 14, as seen in FIGURE 2, is swingably movable with the lower end of the link 20, and as this end of the guide roll 14 is moved, the wire tends to move laterally on the rolls 11, 12 and 13 in a direction dependent on the direction the link 20 swings about its pivot pin 21. The movement of the guide roll 14 in one direction or the other is controlled for altering the lateral positioning of the wire 10, as will be presently described.

The movement of the Fourdrinier wire 10 continuously and at the high rates of speed used in the papermaking process against the water doctor blade 16 causes grooves to form along its thin edge, deeper grooves at wire edge and minute grooves throughout the length of the blade caused by the knuckles of the warp wires.

The minute grooves encourage folds to occur in the wire during lateral movement, while the deeper grooves at the edges of the wire 10 when sufficiently deep can force the edge of the wire 10 to curl upwardly when it moves laterally beyond the groove. This can also result in fraying of the edges of the wire 10 which may cause consequent damage and grooving to the top of the vacuum box 15 and the rolls of the machine over which the wire 10 passes. The present invention therefore contemplates that the Fourdrinier wire 10 shall be moved periodically over the regions which are prone to grooving, thus to evenly distribute wear.

The first bleed valve 33 acts to maintain the wire 10 positioned on the rolls between certain lateral limits. The paddle 41 is set in contact with the edge of the wire 10 so that the bleed valve 33 is partially open when the wire 10 is in its desired lateral position. The tension spring 44 acts upon the upper end of the arm 42 and serves to continuously urge the paddle 41 against the edge of the wire 10. Whenever the wire 10 drifts laterally from a normal running position, the paddle 41 and the arm 42 follow the wire, and the resulting movements of the arm 42 cause related movements of the tapered valve plunger 37 due to the action of the link 46 connecting the arm 42

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and the tapered valve plunger 37. The tapered valve plunger 37 thus varies the flow of the air which is bled to the atmosphere from the pneumatic system.

The air supply 29 is maintained at a constant pressure by the constant pressure regulator 32, and the pressure within the connected conduit 30 is at some lower value due to the presence of the restriction 31.

When the paddle 41 moves so as to further open the bleed valve 33 as the wire 10 drifts laterally in one direction, more air escapes to the atmosphere and drops the pressure in the conduits 35 and 30. When the wire 10 drifts in the opposite lateral direction, the paddle 41 follows so as to close the bleed valve 33 to a greater extent and increase the air pressure in the conduits 35 and 30.

The power unit 24 is mounted so as to act upon the movable end of the guide roll 14 and by means of the flexible diaphragm 26 it responds to changes in pressure in the conduit 30. When the loss of pressure occurs in the conduits 35 and 30, the flexible diaphragm 26 collapses; and the tension spring 28 moves the guide roll 14 so as to move the wire 10 back toward its normal running position. This return movement of the wire closes the bleed valve 33 to a greater extent and causes an air pressure increase in the conduits 30 and 35. The flexible diaphragm 26 consequently moves outwardly; and the longitudinal axis of the guide roll 14 is restored to a neutral position in which the guide roll 14 does not cause further lateral movement of the wire 10.

When the increase of air pressure occurs in the conduits 35 and 30 due to movement of the wire 10, the flexible diaphragm 26 moves outwardly still farther, and the pressure rod 27 moves the guide roll 14 so as to move the wire 10 back toward a normal running position. This wire movement opens the bleed valve 33 to a greater extent causing an air pressure decrease in the conduits 35 and 30. The flexible diaphragm 26 consequently moves inwardly; and the longitudinal axis of the guide roll 14 is restored by means of the tension spring 28 to a neutral position.

During normal machine operation, the wire 10 is controlled, as just described, at all times between certain lateral limits to prevent it from moving beyond the end of the rolls. The wire guide mechanism may be so sensitive as to limit lateral motion to minute fractions of an inch, such that the moving edge of the wire 10 maintains a substantially constant position in its path about the rolls.

The present invention resides particularly in the introduction of the second bleed valve 34 joined to the previously described pneumatic wire guide system through the branch conduit 36. The second bleed valve 34 operates as follows:

The switch 62 is normally closed. When the switch 54 is also closed, an alternating current available from the source 60 passes through the electrical leads 61, 63 and 55 to energize the electrical winding 53. This causes the sudden upward movement of the armature 48 against the action of the compression spring 51 and this results in the removal of the tapered plunger 47 from the tapered aperture 49. A quantity of air is thus exhausted to the atmosphere, reducing the air pressure in the conduits 36 and 30, and thus the flexible diaphragm 26 is collapsed. The tension spring 28 is then effective to move the end of the guide roll 14 to the left as seen in FIGURE 1. In this manner the wire 10 is made to move laterally out of its normal position by a substantial amount.

The electrical synchronous motor 58 drives the shaft 59 and the movable contact 57. When the movable contact 57 passes beyond the point of contact with the fixed contact 56, the circuit is broken and the current no longer flows. The electromagnetic field created by the electrical winding 53 collapses; the compression spring 51 causes the tapered plunger 47 to descend into the tapered aperture 49; and since air is no longer permitted to escape from the system, the pressure in the conduits 36 and 30 builds up to its previous level. The flexible diaphragm

26 then operates through the pressure rod 27 to move the end of the guide roll 14 to its normal position and return the wire 10 to its original position on the rolls.

The operation of the electrical synchronous motor 58 thus causes a periodic making and breaking of contacts in the switch 54 and produces the desired oscillating lateral movement of the wire 10. This action of the bleed valve 34 is over and above the described operation of the bleed valve 33 which functions in itself to maintain the wire 10 travelling in a certain predetermined path about

In a certain particular example of the invention, a cycle of lateral wire movement involving the action of the bleed valve 34 is completed in about 10 seconds. Actuated by the switch 54, the electromagnetically operated bleed valve 34 opens for a period of about two seconds, thus permitting a substantial quantity of air to be exhausted to the atmosphere. Then the bleed valve 34 closes for the rest of the cycle allowing the air pressure in the system to return slowly (due to restriction 31) to a working level of about 15 pounds per square inch.

The cyclical reductions of air pressure by the valve 34 causes an almost continuous movement of the wire 10 through a lateral distance which is preferably $\frac{1}{4}$ inch or more. The movement serves to adequately distribute wear by the wire 10 on the water doctor blade 16, the top of the vacuum box 15, and the rolls of the Fourdrinier machine, so that serious grooving is no longer a problem and equipment life is advantageously lengthened.

We wish it to be understood that the invention is not to be limited to the specific constructions and arrangements shown and described, except only insofar as the claims may be limited, as it will be understood to those skilled in the art that changes may be made without departing from the principles of the invention.

What is claimed is:

1. In combination, an endless belt, a plurality of rolls for holding said belt in the form of a loop, means for driving one of said rolls so as to drive said belt, a paddle in contact with an edge of said belt and movable in response to lateral movement of said belt, a fluid pressure operated mechanism for shifting said belt laterally in one direction or the other, a source of fluid under pressure other than atmospheric for actuating said fluid pressure operated mechanism, a valve connected with said pressure operated mechanism and operated by said paddle for changing the pressure from said source applied to said pressure operated mechanism for moving said belt laterally back to a certain position on said rolls when the belt moves away from its said certain position, a second valve connected with said pressure source and said pressure operated mechanism, and means for intermittently actuating said second valve for causing intermittent movement of said belt laterally away from its said certain position.

2. In combination, a Fourdrinier wire, a plurality of rolls for holding said wire in the form of a loop, means for driving one of said rolls so as to drive said wire, a doctor blade acting on the surface of said wire and subject to wear, a paddle in contact with an edge of said wire and movable in response to lateral movement of said wire, one of said rolls being movably mounted on one end so as to cause lateral movement of said wire as said end is moved, a fluid pressure operated mechanism acting on said movable roll end, a source of fluid under pressure other than atmospheric for actuating said mechanism, a valve

connected with said pressure source and said mechanism and operated by said paddle for changing the pressure from said source applied to said mechanism for moving said wire laterally back to a certain position on said rolls when the wire moves from its said certain position, a second valve connected with said pressure source and said mechanism, and means for intermittently actuating said second valve for intermittently changing the pressure from said source applied to said mechanism for causing intermittent movement of said wire laterally away from its certain position so as to cause said doctor blade to wear evenly along its edge in contact with said wire.

3. In combination, a Fourdrinier wire, a plurality of rolls for holding said wire in the form of a loop, means for driving one of said rolls so as to drive said wire, a paddle in contact with an edge of said wire and movable in response to lateral movement of said wire, one of said rolls being movably mounted on one end so as to cause lateral movement of said wire as said end is moved, an air pressure operated diaphragm mechanism acting on said movable roll end for moving said wire in a lateral direction, a source of air pressure connected to said diaphragm mechanism, a bleed valve operated by said paddle for relieving the air pressure applied to said diaphragm for moving said wire laterally back to a certain position on said rolls when the wire moves from its said certain position, and an intermittently operated bleed valve connected with said air pressure source and said diaphragm mechanism and in parallel with said first named bleed valve for causing intermittent movement of said wire laterally away from its said certain position.

4. In combination, a Fourdrinier wire, a plurality of rolls for holding said wire in the form of a loop, means for driving one of said rolls so as to drive said wire, a paddle in contact with an edge of said wire and movable in response to lateral movement of said wire, one of said rolls being movably mounted on one end so as to cause lateral movement of said wire as said end is moved, an air pressure operated diaphragm mechanism acting on said movable roll end for moving said wire in a lateral direction, a source of air pressure connected to said diaphragm mechanism, a restriction between said source of air pressure and said diaphragm mechanism, a bleed valve operated by said paddle for relieving the pressure applied to said diaphragm mechanism for moving said wire laterally back to a certain position on said rolls when the wire moves from its said certain position, a second bleed valve connected with said air pressure source and said diaphragm mechanism and in parallel with said first named bleed valve, an electromagnet to actuate said second bleed valve, a source of electric current for said electromagnet, a switch electrically connected in series with said electromagnet, and means for opening and closing said switch at predetermined intervals thus intermittently bleeding air from said second valve and varying the position of said wire from said certain position intermittently.

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