April 11, 1961 F. W. RALPH 2,979,280

WEB TENSION CONTROL

Filed Dec. 10, 1958 3 Sheets-Sheet 1

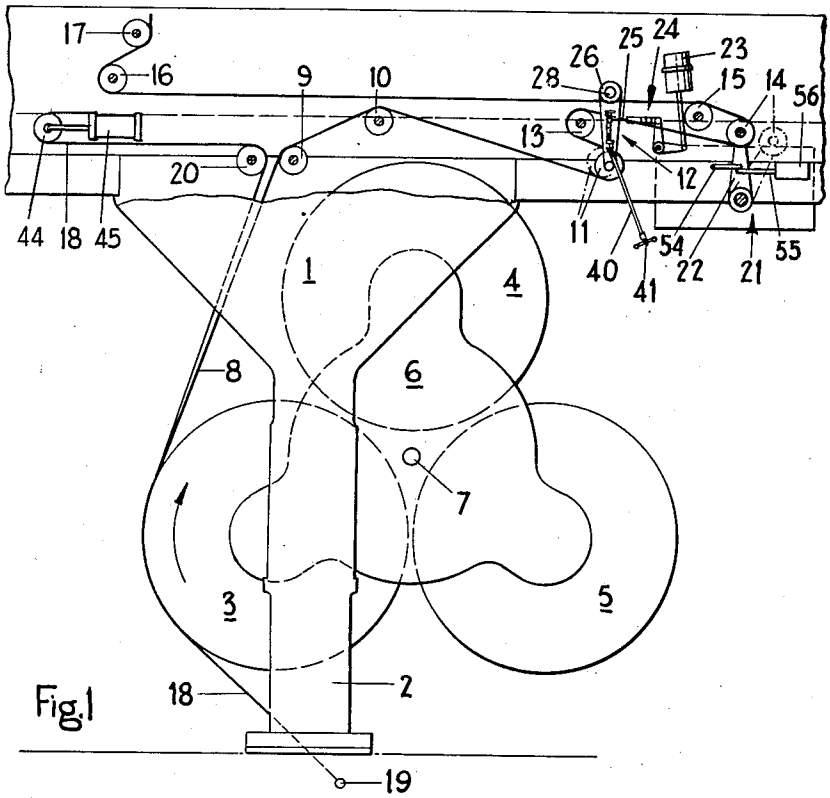


Fig.1

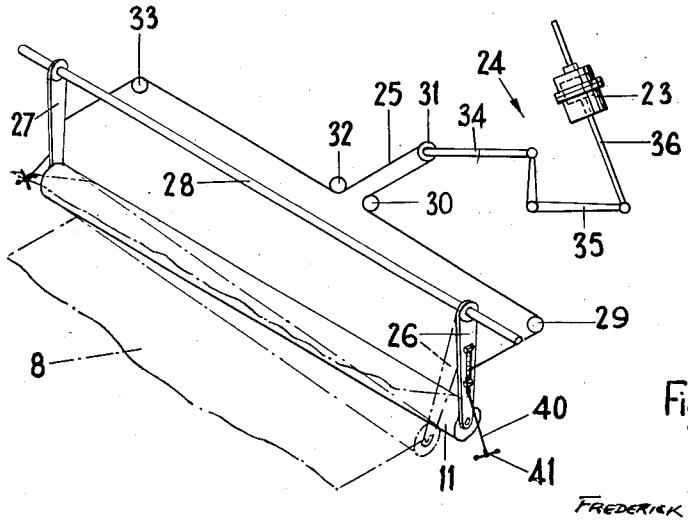


Fig.2

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WEB TENSION CONTROL

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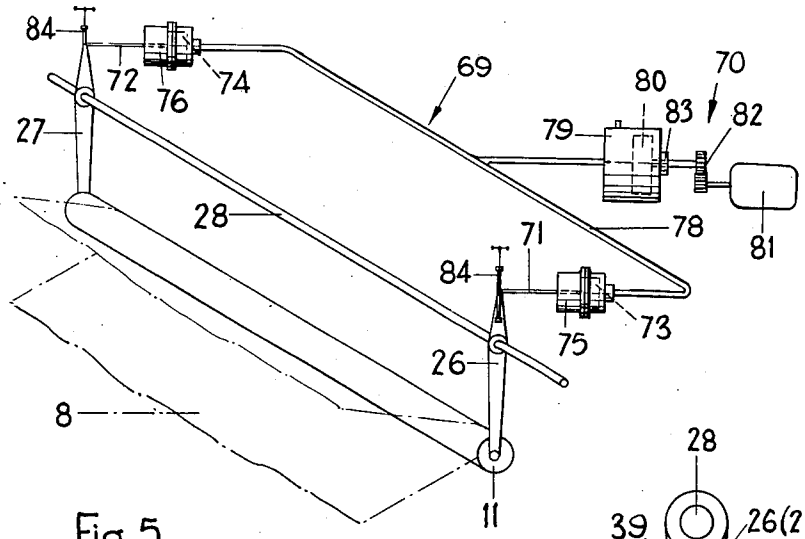


Fig. 5

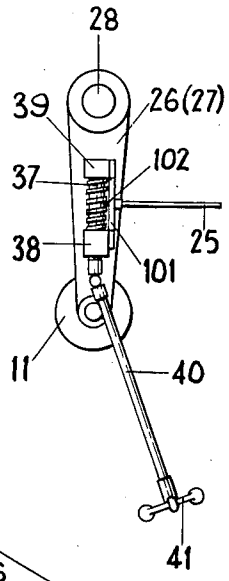


Fig. 3

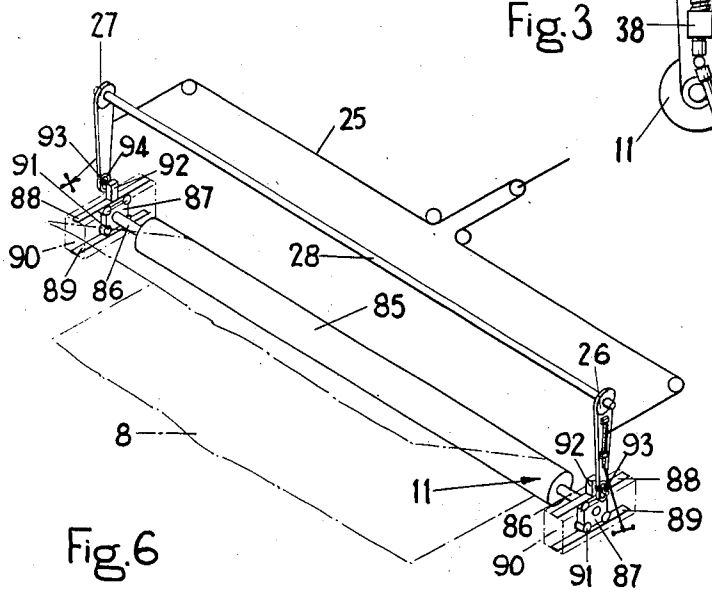


Fig. 6

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WEB TENSION CONTROL

Filed Dec. 10, 1958

3 Sheets-Sheet 3

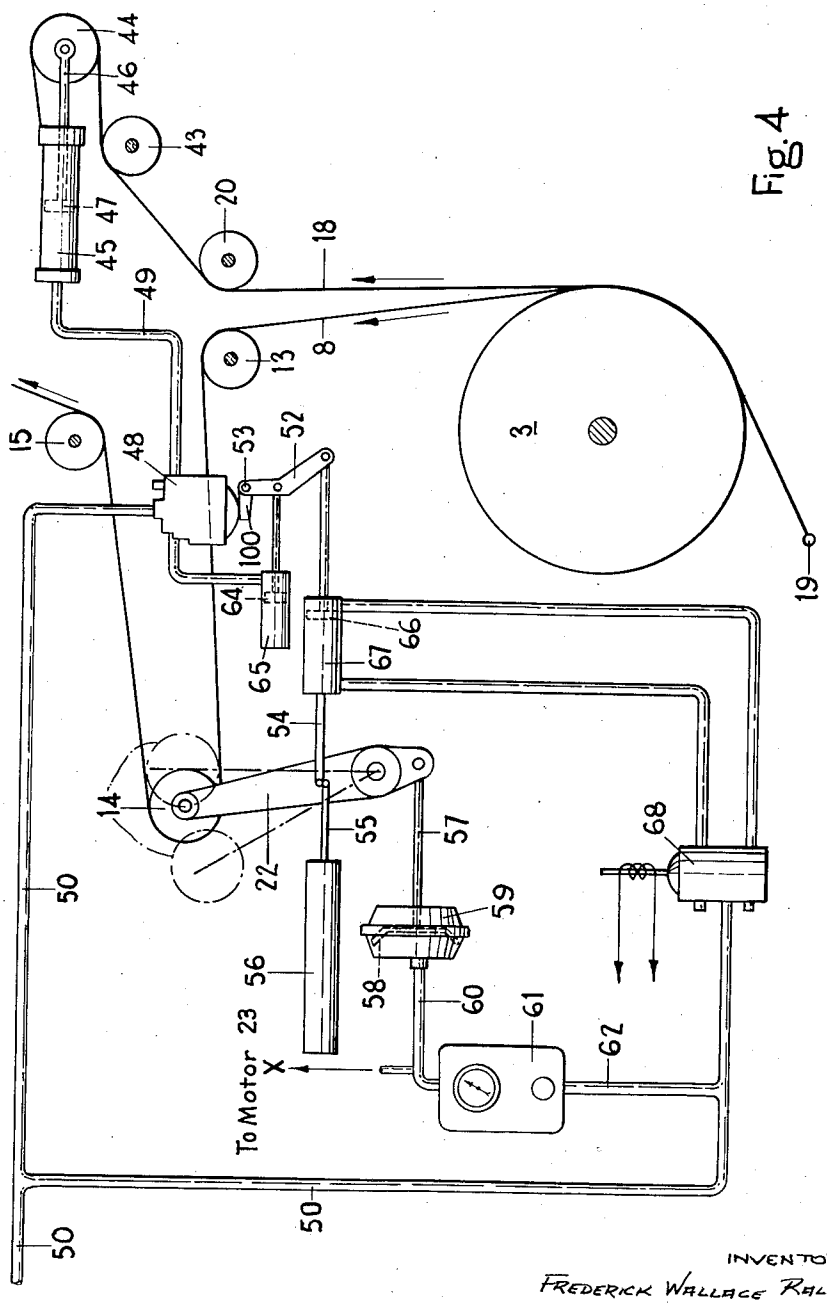


Fig. 4

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WEB TENSION CONTROL

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8 Claims. (Cl. 242—75.42)

The present invention relates to web control arrangements and is more particularly but not exclusively concerned with the control of a paper web run from a reel into or through a printing press or associated equipment.

According to the present invention, a web control arrangement comprises a roller or the like web support capable of lateral movement and over the surface of which a web is arranged to run, and a linkage interconnecting the ends of the roller or the like web support and through which a force is arranged to be applied to urge the roller in a web tension direction.

Actuating means responsive to the web tension may be provided for applying a force whose magnitude is dependent upon the web tension to urge the roller or the like web support in a web tensioning direction.

The roller or the like web support may be capable of lateral cocking movement, that is to say, capable of lateral movement in which its ends are displaced relatively to each other and the linkage so arranged that unevenness in tension between the longitudinal edges of the web cause lateral cocking movement of the roller or the like web support in a sense tending to equalise the tension between the edges of the web.

The roller or the like web support may alternatively be disposed for lateral movement along guides which constrain the roller or the like web support to move parallel to itself. Such an arrangement is convenient for taking up slack in a web and preventing breakage in the web if it runs too tightly.

In order that the present invention may be readily understood, three web control arrangements as incorporated in a reelstand for a printing press will now be described by way of example with reference to the six figures of the accompanying drawings.

In the drawings,

Figure 1 shows a diagrammatic front elevational view of the reelstand;

Figure 2 shows a schematic representation of one of the arrangements;

Figure 3 shows a detail;

Figure 4 shows a diagrammatic view of the tensioning equipment;

Figure 5 shows a schematic representation of the second arrangement; and

Figure 6 shows a schematic view of the third arrangement.

Referring now to Figure 1 of the drawings, a typical reelstand for a printing press is shown somewhat diagrammatically. The reelstand includes a framework 1 mounted on the floor of the building containing it. The framework comprises two similar spaced parallel frame members 2 between which the reels of paper 3, 4 and 5 are supported. The reels 3, 4 and 5 are actually mounted on a spider framework 6 having three similar reel supporting means symmetrically disposed about a central axis 7. One of these means supports the running-web reel 3 from which the web 8 is drawn into the printing press. Another of the means supports the replacement

web reel 6, that is the web which is joined at the appropriate time to the running web 8. The third means supports the newly loaded reel 5. The spider framework 6 is rotatably supported in the framework 1 being rotatable about the axis 7 to bring the reels 3, 4 and 5 to their predetermined positions in known manner. Figure 1 shows only those parts of the reelstand necessary for an understanding of the invention.

The web 8 passes from the reel 3 over support rollers 9 and 10 suitably supported in the framework 1 to a roller 11 which forms part of the web control arrangement—indicated generally at 12—which is the subject of the invention. After passing over roller 11 it passes over rollers 13 to 17 and into the printing press. Tension straps 18 are disposed parallel to each other and frictionally engage the surface of the reel 3 to impart a tension to the web 8. The straps are secured at one end to a suitable anchorage 19 and pass from the surface of the reel 3 over a roller 20 and into tensioning equipment which is arranged to impart a desired tension to the straps 18. The tensioning equipment is arranged to measure the tension in the web 8 and to automatically adjust the tension in the straps 18 if the tension in the web 8 varies from a predetermined amount. The measuring means of the tension equipment is indicated at 21 and incorporates a roller 14 which is mounted on the end of a pivoted arm 22. The position of this arm 22 (two positions of the arm 22 and roller 14 being shown) is arranged to give a measure of the tension in the web 8 and by suitable pneumatic control means as will be described with reference to Figure 4, the tension in the straps 18 can be controlled in dependence upon the position of the arm 22.

The web control arrangement 12 has actuating means 23 connected through a pivoted lever mechanism 24 to a linkage 25 connecting at its ends with arms 26 and 27. The arms 26 and 27 are pivotally mounted at their upper ends through a shaft 28 to the framework 1 and at their lower ends support the roller 11.

Referring now more particularly to Figure 2, which shows schematically the first web control arrangement, the linkage 25 comprises a rope or cable which is passed around pulleys 29 to 33 to form it into a loop having two sides perpendicular to the axis of the roller 11 and a third side which is substantially parallel to the axis of the roller 11. The pulley 31 is disposed at the end of a lever 34 of the lever mechanism 24 and is mid-way between the rollers 29 and 33. The lever 34 is connected to one end of a crank 35 pivotally mounted on the framework 1 at the junction of its limbs and to the other end of which is pivotally connected a rod 36 of the actuating means 23. The actuating means 23 is a diaphragm air motor connected in a pneumatic circuit with the tension measuring means 21.

Any change in tension in the web varies the force applied to the roller 11 through the lever mechanism 24 and linkage 25 in a manner to be described.

The ends of the rope or cable connected to the arms 26 and 27 are so connected as to permit adjustment of the distance between the shaft 28 and the connecting point. The connecting arrangement is clearly shown in Figure 3 and comprises a worm 37 extending along the arm 26 (27) and rotatably mounted in bosses 38 and 39 secured to the arm 26 (27). Connected to the lower end of the worm 37 is a hand wheel arrangement comprising a rod 40 and hand wheel 41 by which the worm can be rotated. The rope or cable 25 is connected to a plate 101 having a tooth 102 projecting therefrom and engaging in the worm 37 so that rotation of the worm causes sliding movement of the plate 101 along the surface of the bosses and thus variation of the position of the connecting point. This arrangement provides for

the use of fractional width reels, i.e. reels which do not extend over the whole width of the roller **11**, which are unsymmetrically disposed on the roller. By adjustment of the position of the connecting point the moment of the force acting at the ends of the roller can be so proportioned that for an unsymmetrically disposed reel the force balancing out the component of the tension in the web **8** is so distributed that the roller **11** is maintained substantially parallel to a line joining the pulleys **29** and **33**.

Referring now more particularly to Figure 4, which shows a schematic representation of the tensioning equipment, the reel **3** and tensioning straps **18** are shown. The straps **18** pass over the pulleys **20** and further pulleys **43** and **44** and are each anchored to a belt tension cylinder **45**. The pulleys **44** are disposed at the ends of piston rods **46** each having a piston **47** disposed in one of the cylinders **45** connected to a tension control valve **48** by a pipe line **49**. The valve **48** is connected to a high pressure supply through pipe-line **50**. A lever **52** is pivotally mounted at **53** and carries a valve operating arm **100** which in the position shown closes the pipe-line **49**. If the operating arm **100** is raised by rotation of the lever **52**, it connects the pipe-line **49** to the pipe-line **50** and if lowered opens the pipe-line **49** to the atmosphere. The lever **52** is pivotally connected to an arm **54** which connects with the arm **22**, carrying the roller **14**. An arm **55** connected to a damper **56** also connects with the arm **22**. At the lower end of the arm **22** is connected a rod **57** connected to the diaphragm **58** of a diaphragm air motor **59**. The diaphragm air motor **59** is connected by a pipe-line **60** through a manually operated tension regulator **61** and pipe-lines **62** and **50** to the high pressure air supply. A connection to the diaphragm air motor **23** which constitutes the actuating means is indicated by the arrow "X."

Cylinder **65** and piston **64** are merely a balancing arrangement to balance out the restoring force of a spring in the valve **48** to permit operation of the valve by a small operating force and the piston **66**, cylinder **67** and solenoid operated valve **68** are merely to provide a quick release of the tension. No further reference will be made to these parts since they are only refinements of the basic system.

In operation of the tensioning equipment, the air pressure acting on the diaphragm air motor **59** is adjusted by the regulator **62** so that the force applied at the lower end of the arm **22** is of a predetermined value to set the tension in the web **8** to a desired value. If now the roller **14** moves to the left indicating a decrease in the tension in the web **8**, the rod **54** moves the lever **52** to cause the arm **100** to open the valve **48** to connect the pipe-lines **49** and **50** to increase the pressure in the cylinders **45** and thus cause the pistons **47** to move outwards to increase the tension in the straps and thus the tension in the web **8**. On increase in the tension of the web **8** the arm **22** moves back to its normal position.

Movement of the arm **22** in the opposite direction will cause opening of the valve **48** to atmosphere to decrease the air pressure in the cylinders **45**, the operation of the system being the same in principle as before.

In operation, the force applied to the ends of the roller **11** by the actuating means **23** is such that it balances out the component of tension of the web **8** acting on the roller **11** to maintain the roller in the mean position. As the web **8** is run from the reel **3** the tension in the web may vary from time to time and as described above the force applied to the ends of the roller is automatically varied in correspondence therewith.

Due to the varying nature of the paper and the uneven manner in which the reel **3** may be wound there may be unevenness in tension between the two opposite edges of the web. This is undesirable and in order to reduce or eliminate the unevenness, the web-control arrangement **12** is provided. If, for example, the tension at the edge of the web **8** nearer the arm **26** is greater than the tension at the edge nearer the arm **27**, this inequality of forces on the two ends of the roller **11** causes the arm **26** to rotate to the position shown in chain line. Now since the linkage **25** is inextensible it is pulled around the pulleys to displace the other end of the roller **11** and the arm **27** in the opposite direction to cause the roller to engage the web **8** at this edge with a greater force and thus displace this edge of the web **8** in a direction to increase the tension therein. Thus the roller **11** has a lateral cocking movement which displaces the web in a direction tending to equalise the tension between the two edges thereof.

In the case where a fractional width reel of three quarter width is used and is disposed with half its width on one side of the mid-point of the roller **11** and a quarter on the other side, the connecting point of the rope or cable **25** to the arm **26** would have to be so adjusted that the force applied to that end of the roller **11** connected to the arm **26** is one and two thirds as great as the force applied to the other end of the roller **11** in order to maintain the roller **11** parallel to a line joining the pulleys **29** and **33** and thus parallel to the general plane of the web. If the forces are not so adjusted then the roller **11** is cocked and may come up against one of its limit stops (not shown) at one end and this is undesirable.

If the roller should move out of its mean position due to the tension increasing momentarily, the linkage means **24** rotates from the position shown about the pivotal axis of the crank **35**. From an inspection of the drawing it will be seen that this causes the force applied to the ends of the roller **11** to increase since the angle at which the rod **36** transmits the force applied by the actuating means **23** to the crank **35** increases. This increase in the force minimises the risk of the arms **26** and **27** moving to their limit stops.

Referring now more particularly to Figure 5 of the drawings, the second arrangement is a modification of the first arrangement, the rope or cable linkage being replaced by a pneumatic linkage **69** and electrically operated actuating means **70** being used. The same reference numerals have been given to parts repeated from the first arrangement.

In the second arrangement, the levers **26** and **27** are connected to the ends of piston rods **71** and **72** carrying pistons **73** and **74** disposed in cylinders **75** and **76** which are connected to the ends of a pipe line **78** to form a fluid circuit which is in effect closed at its ends by the pistons **73** and **74**. Connected in the pipe line **78** is a cylinder **79** in which is disposed a control piston **80** whose position determines the pressure of fluid in the circuit and thus the force applied to the ends of the roller **11**. The position of the control piston **80** is controlled by an electric motor **81** being connected thereto through gearing **82**, the piston rod being screw threadedly mounted in a bush **83**. The electric motor is controlled by the tension measuring means of the tensioning equipment but this time through relays or the like so that the force applied by the actuating means **70** is dependent upon the tension in the web.

The second arrangement provides for fractional width reels unsymmetrically disposed on the roller **11** by a connecting arrangement **84** similar to that of the first arrangement, or alternatively by making the piston **73** a multi-poppet piston which can be suitably adjusted.

As will be appreciated the principle of operation will be the same as for the first arrangement but in this case it will be the transfer of fluid in the closed circuit which will cause lateral cocking movement of the roller **11**.

Referring now more particularly to Figure 6, the roller **11** is in this embodiment a parallel motion roller and comprises a pipe **85** mounted for free rotation on a shaft **86** which at its ends is mounted in carriages **87**. The carriages **87** are mounted between tracks **88** and **89**, one

above and one below the carriages 87, the tracks being provided in guide blocks 90 secured to the reel stand. Roller bearings 91 are provided on the carriages 87 and support the carriages 87 on the tracks 88 and 89. The carriages 91 have arms 92 connected thereto by pins 93 on the carriages 87 engaging in slots 94 in the end of the arms 92. The arms 92 are pivotally mounted at their lower ends and are connected to a linkage and actuating means in exactly the same manner as the arrangement of Figure 1.

In operation, the roller 11 is in a position in which the component of tension in the web acting on the roller is balanced by the force applied to the roller 11 by the actuating means. Any tendency for the tension of the web to increase or decrease causes a corresponding movement of the roller 11 parallel to itself along the tracks. For example, if the web momentarily lengthens due to an irregularly wound reel, the decrease in tension caused thereby would cause the roller 11 to move to engage the web and prevent the web running slack. Further if the web is momentarily decreased in length, the roller 11 is moved by the web and prevents breaking of the web, since the component of tension is momentarily greater than the force applied by the actuating means. Another contingency besides an irregularly wound reel which the roller assembly deals with is the "take-up" and "letting out" of paper during conditions where the reel 3 is accelerated or decelerated or where the reel 3 is rapidly brought to rest under, say, emergency conditions.

Although the invention has been described with reference to paper webs, it is not necessarily restricted thereto. Also although the web control arrangement has been shown on the reelstand, it may be positioned at any other convenient point along the path of the web.

I claim:

1. An arrangement for maintaining the tension at a substantially constant value in a web being run from a reel mounted in a reelstand, said arrangement comprising: tensioning equipment mounted on the reelstand for imparting a tension to the web at the reel, regulator means adjustable to set the tensioning equipment to provide a desired tension in the web, a roller web support mounted for movement in a direction transverse to its longitudinal axis and over which the web from the reel runs with said web support disposed with its length across the width of the web and with the web wrapped partially around said web support, and actuating means adjusted by said regulator means for applying a force to said web support in a direction opposing the component of the tension in the web acting on said web support.

2. An arrangement as set forth in claim 1, wherein a linkage interconnects the ends of the web support and causes movement of the ends of said web support in opposite directions when one end of said support is displaced by the web due to unevenness in tension between the longitudinal edges of the web so that the web support cocks in a sense tending to equalize the tension between the longitudinal edges of the web.

3. An arrangement as set forth in claim 2, wherein the linkage comprises an inextensible flexible member and fixed guides around which the inextensible flexible member passes, the actuating means applying the force to the web support through said inextensible flexible member by creating a tension in said inextensible flexible member.

4. An arrangement as set forth in claim 2, wherein the linkage comprises a closed fluid circuit having a pipeline, a pair of cylinders connected in the pipeline and a pair of pistons disposed one in each cylinder to close the circuit and connected one at each end of the web support, the actuating means being arranged to control the fluid pressure in the circuit.

5. An arrangement as set forth in claim 2, wherein a pair of independently rotatable arms carry the web support between them, and the linkage is connected at its ends to said arms.

6. An arrangement as set forth in claim 2, wherein a pivoted lever mechanism including a pivoted crank connects the actuating means to the linkage to increase the force applied to the ends of the web support for a constant force exerted by the actuating means as the web support moves from a mean position parallel to itself under the force of the web.

7. An arrangement as set forth in claim 1, wherein guides constrain the web support to move parallel to itself.

8. An arrangement as set forth in claim 7, wherein supporting carriages are provided towards the ends of the web support and wherein guide tracks for said carriages are disposed above and below said carriages.

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