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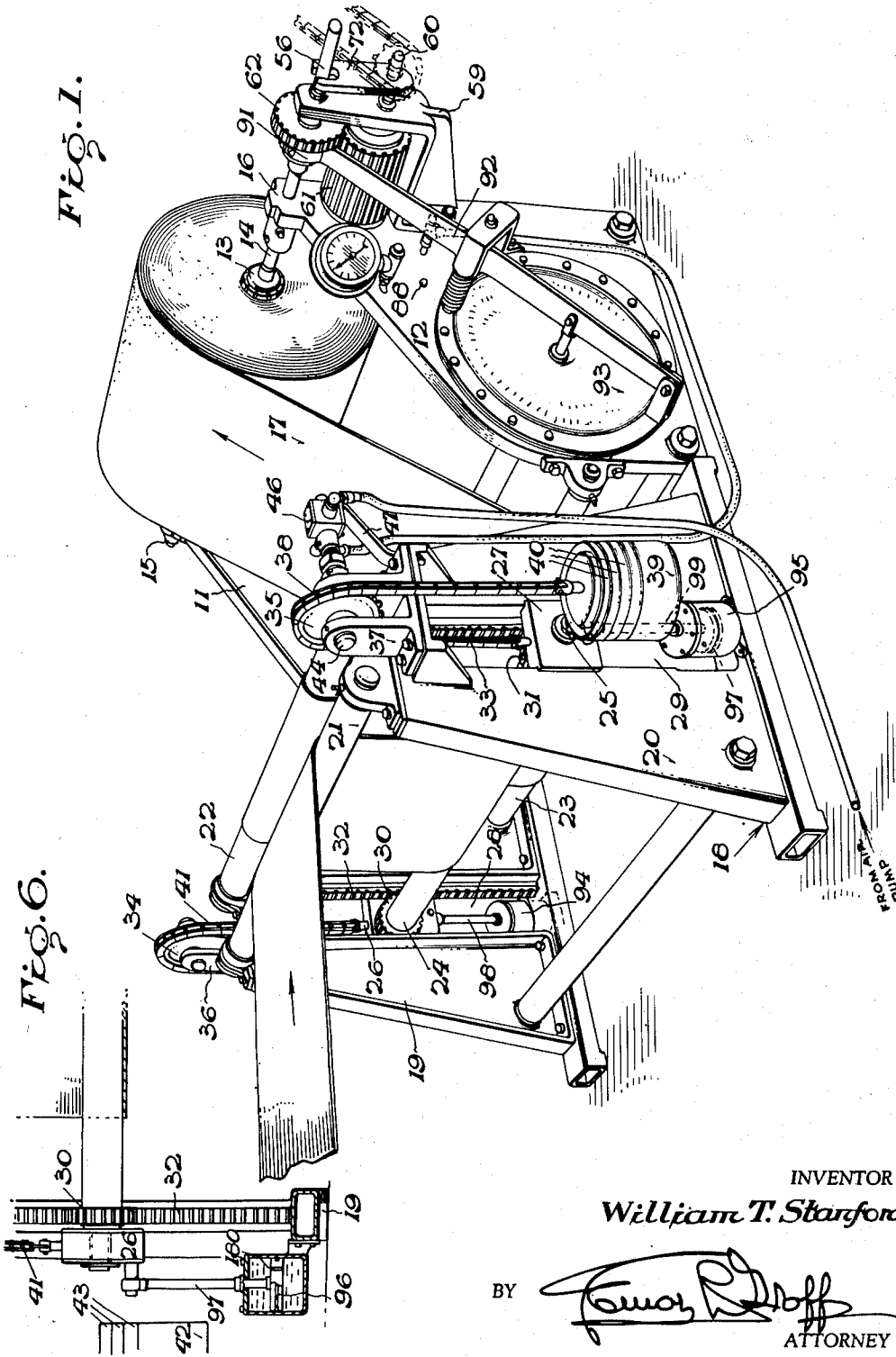
2,635,825

WEB WINDING AND UNWINDING CONTROL

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3 Sheets-Sheet 1

FIG. 1.



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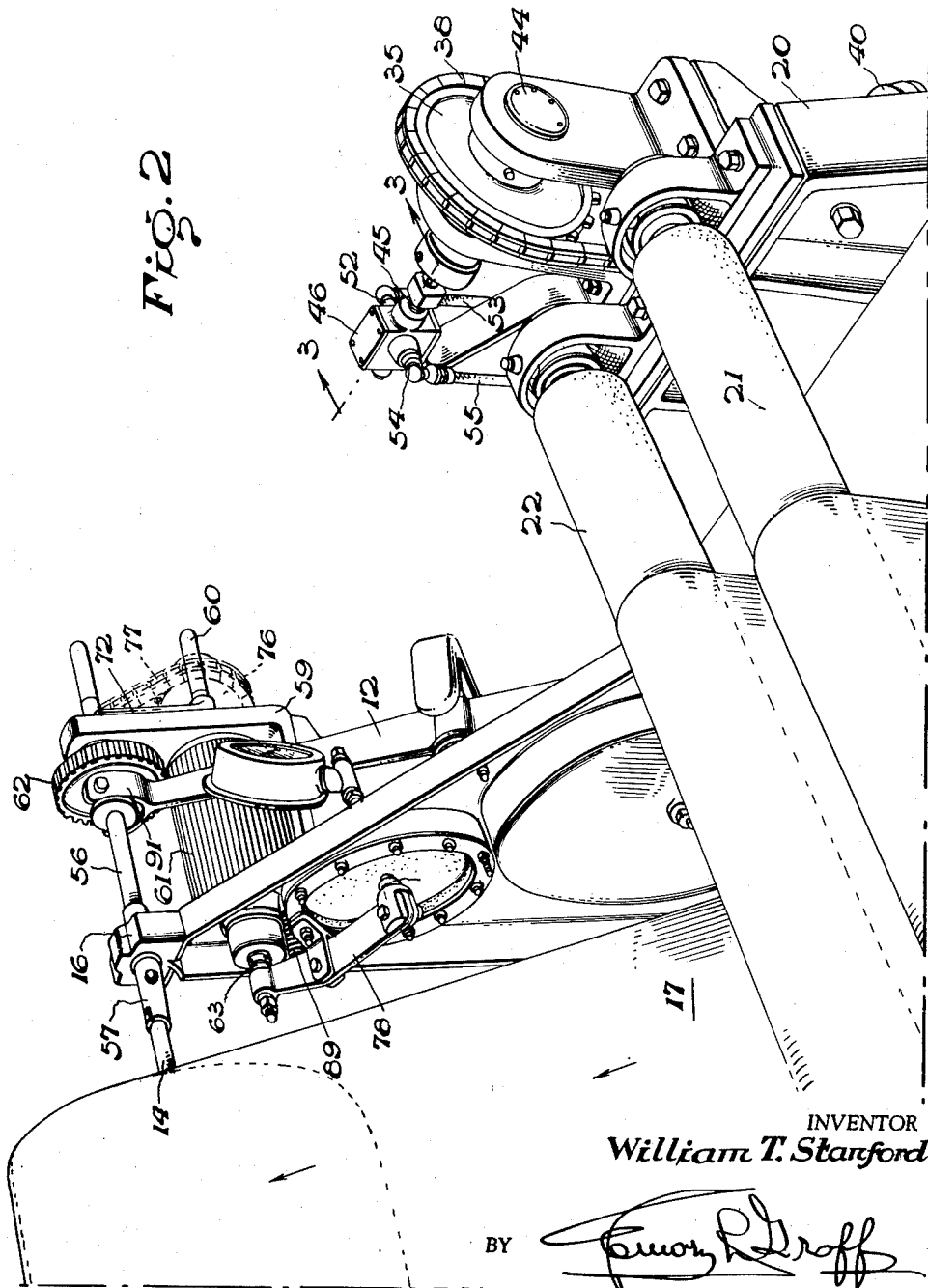
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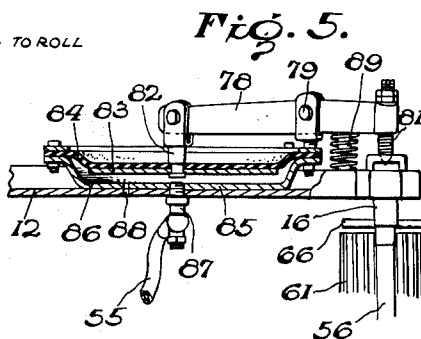
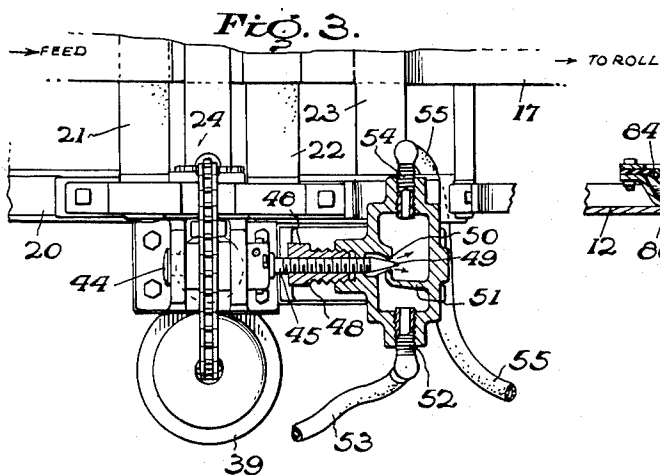
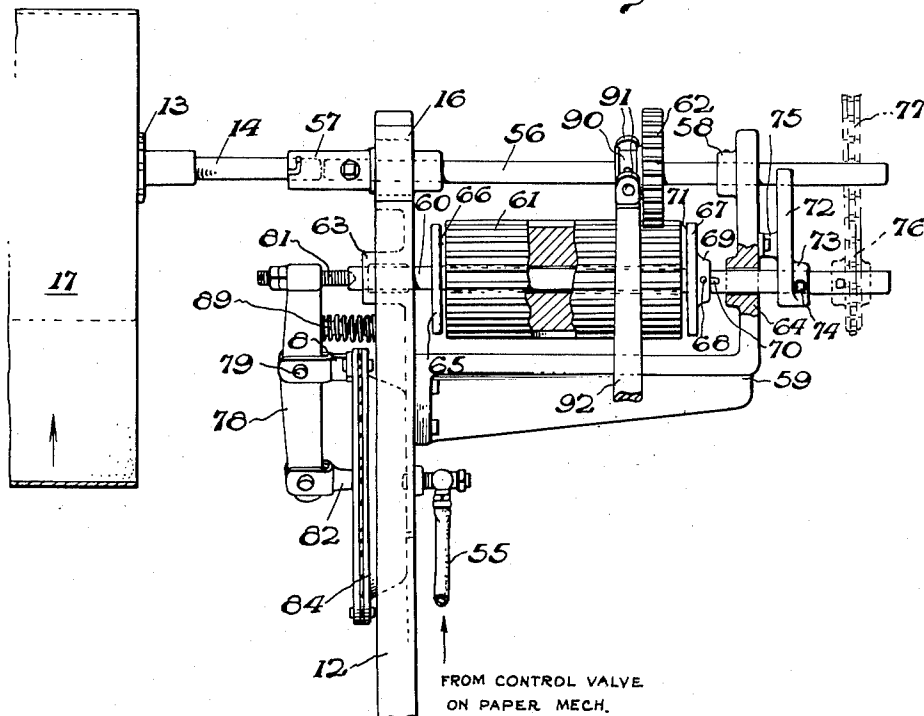


Fig. 4.



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WEB WINDING AND UNWINDING CONTROL

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7 Claims. (Cl. 242—75)

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This invention relates to machines for winding and unwinding sheets or webs of material, such as paper, cloth and other materials and is more particularly concerned with means for changing the speed of the roller upon which the material is being wound or from which it is being unwound to compensate for changes in the tension of the web.

An object of this invention is the provision of means for automatically controlling the speed of the web roller as the web is being either wound or unwound.

Another object of the invention is to provide such means which is positive in operation and which is sensitive in its response to changes in a predetermined web tension.

A further object is the provision of such means which are long wearing, inexpensive to operate and not likely to get out of order.

A still further object is the provision of a mechanism in combination with a web roller in a machine of the type mentioned which includes a combined braking and clutching unit associated with the roller and means for actuating the unit to an extent proportional to the stress in the web material.

A still further object is the provision of such means in combination with a web guiding device.

These and other objects and advantages of the invention will appear from the following description considered together with the accompanying drawing in which drawing:

Figure 1 is a perspective view of certain elements of a web winding machine in combination with an embodiment of this invention.

Figure 2 is a perspective view of a portion of the same machine from a different position.

Figure 3 is a section along the line 3—3 of Figure 2.

Figure 4 is a plan view of the braking and clutching unit and the diaphragm actuating linkage connected thereto.

Figure 5 is a cross sectional view of the diaphragm element together with the linkage system associated therewith.

Figure 6 is a fragmentary view of one side of the embodiment showing in section one of the dash-pot units.

Referring with more particularity to the drawing in which like numerals designate like parts the embodiment illustrated comprises a web winding and unwinding machine having suitable frame members 11 and 12 which carry a roller 13 on a shaft 14. Said shaft is mounted in suitable bearings 15 and 16 on said frame members.

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The roller is adapted to be rotated in either a clockwise or a counterclockwise direction in order to wind or unwind a web of material, such as the paper web 17.

In front of the roller a tension unit 18 is disposed comprising frame members 18 and 19 between which is mounted a pair of fixed idler rollers 21 and 22 at the top. A fixed bottom roller 23 is disposed between said frame members 19 and 20 below the rearward roller 22. A vertically movable roller 24 is disposed below the space between the upper rollers 21 and 22. The shaft 25 of said movable roller is journaled at either end in blocks 26 and 27 which slide in vertical guideways 28 and 29 in said frame members 19 and 20, respectively. The shaft 25 is also provided with pinions 30 and 31 on either side which mesh with vertical racks 32 and 33 secured to the inner side of the frame members 19 and 20, respectively, adjacent the guideways.

At the top of each frame member 19 and 20 there is mounted a vertical sprocket 34 and 35 on brackets 36 and 37, respectively. The sprockets are situated midway between the axes of the rollers 21 and 22 and at right angles thereto.

A sprocket chain 38 is secured at one end to the block 27 and passes over the sprocket 35. The other end of the chain is provided with a dancer or support block 39 upon which counterweights 40 may be removably placed.

A similar sprocket chain 41 is secured at one end to the block 26 and passes over the sprocket 34, the other end being also provided with a dancer or supporting block 42 to removably carry counterweights 43.

The sprocket 35 is carried on a shaft 44 which is journaled in suitable bearings on the bracket 37. Said shaft 44 is connected to the stem 45 of a needle valve 46 attached to the said bracket 37 by an arm 47. The valve stem 45 is threadedly engaged with an elongated gland nut 48 on one side of the valve body and its needle point 49 is adapted to seat in the valve seat 50 disposed in a partition 51 within the valve body. Accordingly, rotation of the shaft 44 in one direction will cause the point 49 to advance toward its seat 50 and rotation in the opposite direction will cause it to retract from the seat.

The valve inlet 52 is disposed through the valve body on one side of the partition 51 and is connected to a hose 53 which leads to a pressure pump (not shown). The outlet 54 of said valve is disposed through the valve body on the other side of the partition and is connected to a hose 55

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leading to a diaphragm device hereinafter more fully described.

The shaft 14 of the roller 13 is connected to an extension shaft 56 by means of a connecting sleeve 57. Said sleeve is rotatably supported in the bearing 16 and the other end of the extension shaft is supported in bearing 58 of a bracket 59 secured to the frame member 12.

Parallel to the extension shaft 56 is disposed a shaft 60 that carries an elongated gear 61. Said gear is rotatable and slidable on the shaft 60 and is in constant mesh with another gear 62 on the extension shaft 56. The shaft 60 is carried in bearings 63 in the frame member 12 and 64 in the bracket 59.

Between the bearing 63 and the elongated gear 61 there is fixed to the shaft 60 a plate 65 the inner face of which carries a friction facing 66 such as cork or other suitable material. On the opposite side of the shaft 60 between the bearing 64 and the gear 61 there is keyed to the shaft another plate 67 which is axially slidable on said shaft by means of a pin 68 through the collar 69 of the plate operating in a longitudinal groove 70 of the shaft 60. The collar 69 is adapted to abut the inner side of the bearing 64 as the shaft 60 moves to the right as viewed in Figure 4. The plate 67 carries a similar friction facing material 71 on its inner side. The gear 61 is rotatably mounted on the shaft 60 so as to be both axially displaceable thereon and rotatable relative thereto. The entire shaft 60 is also axially displaceable in its bearings 63 and 64. By these means translation of the shaft 60 in the direction toward the bearing 64 will cause the sides of the gear 61 to come in frictional contact with the plate facings 66 and 71 and therefore effect a braking action when the gear 61 is being driven by the gear 62. When the roller 13 is rotating to unwind a roll of material the shaft 60 is held in a non-rotative position. This is accomplished by means of an arm 72 having a collar 73 at one end, said collar being removably disposed on the shaft 60. The other end of the arm 72 is bifurcated to straddle the extension shaft 56 as shown in Figure 1. The collar 73 is removably secured to the shaft 60 by means of a set screw 74 or by other suitable means. An abutment 75 projects laterally from the arm 72 to contact the side of the bearing 64 or some other suitable fixed member. By these means the maximum spacing between the collar 69 and the inner side of the bearing 64 may be adjusted for any given operation.

Should it be desired to wind material on the roller 13 instead of to unwind it, the arm 72 is removed from the shaft 60 and a sprocket 76 is substituted therefor to permit the application of power to the shaft from a motor (not shown) through a sprocket chain 77. However, other suitable power trains may be employed, the means shown being for illustrative purposes only. As the shaft 60 is rotatably driven it carries with it the plates 65 and 67. Lateral movement of the shaft will then cause said plates to frictionally engage the gear 61 and drive it to an extent dependent upon the pressure exerted by the axial displacement. It may be seen, therefore, that the extent to which the roller is forced to rotate by the application of power to the shaft 60 or permitted to rotate when power is not applied to the shaft 60 is a function of the lateral displacement of the shaft 60 causing, on the one hand, a clutching action between the plates 65 and 67 and the gear 61 and, on the other hand, braking action between said plates and gear.

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The control of the lateral movement of the shaft 60 is effected through a lever 78 which is pivoted at 79 to an arm 80 extending from the inner side of the frame member 12. One end of the lever 78 engages the inner end of the shaft 60 and a thrust bearing 81 is disposed therebetween. The other end of the lever 78 is pin connected to an arm 82 which is attached to a laterally movable disc 83 that is secured to a flexible diaphragm 84. The diaphragm and plate as a unit is disposed in spaced relation to a wall 85 and the edges of the diaphragm are hermetically attached to the wall. The space 86 between the diaphragm and the wall communicates with a short pipe 87 connected to the hose 55 leading from the outlet 54 of the valve 46. A vent or bleed hole 88 is provided through the wall 85 of predetermined size such as $\frac{1}{8}$ inch in diameter, so that air passing into the space 86 will escape through the vent and prevent the constant building up of the pressure beyond a predetermined point for any given quantity of air passing into the said space. The quantity of air is controlled by the needle valve 46 which is in turn controlled by rotation of the sprocket 35.

The web from the roller 13 passes under the fixed bottom roller 23, then upward and over the rear upper fixed roller 22, then downward and around the movable roller 24 and thence upward and over the forward upper fixed roller 21. The weight of the movable roller 24 is counterbalanced by a predetermined tension in the web supplemented by the weights 40 and 43. Accordingly, any changes in the tension in said web results in a movement up or down of the roller 24, depending upon whether the change is positive or negative, thereby causing the sprocket 35 and its shaft 44 to rotate and operate the valve stem 45 toward or away from its seat 50 a corresponding amount. By these means pressure on the diaphragm 83 is modified and causes it to move under the action of a spring 89 disposed between the lever 78 and the frame member 12. Said spring has a tension designed to yield under pressure on the diaphragm developed by the air pressure.

Movement of the arm 78 results in a lateral displacement of the shaft 60 to effect a braking action or a clutching action as the case may be to the extent of the movement.

The shaft 14 and its extension 56 are also axially displaceable in their bearings and the collar of the gear 62 is provided with an annular peripheral groove 90 which is rotatably engaged with a yoke 91 at one end of a lever arm 92. Said lever arm is a part of a web guiding unit 93 as shown and described in U. S. Patent No. 2,434,128 issued January 6, 1948.

In order to prevent hunting, suitable dash-pot means are provided. In the drawing a suitable form of dash-pot is shown consisting of cylinders 94 and 95 secured to the frame members 19 and 20 at the bottom of the guideways 28 and 29, respectively. Said cylinders are filled with oil or other fluid and contain vertically movable pistons 96 and 97 therein. Said pistons are connected to piston rods 98 and 99 which slidably operate through the top of the cylinders. The upper ends of said piston rods are connected to their corresponding block members 26 and 27, substantially as shown. The pistons 96 and 97 are provided with bypass apertures 100. By these means movement of the roller 24 up and down is damped thereby stabilizing the position of the roller 24 quickly, following any change in the web tension.

I claim:

1. In a machine of the type described having a roller for carrying a web in rolled form, a shaft secured to said roller, a first gear rotatable with said shaft, a second gear in meshed relation with said first gear, friction plates for variably engaging the sides of said second gear, a shaft supporting said second gear and friction plates, said friction plates being rotatable with and said second gear being rotatable relative to said last named shaft, idler rollers for unrolled portions of the web, at least one of said idler rollers being movable in response to changes in tension in said web, means responsive to movements of said movable roller for actuating said friction plates relative to said second gear and means for damping the movements of said movable roller.

2. In a machine of the type described having a roller for carrying a web in rolled form, a shaft secured to said roller, a first gear rotatable with said shaft, a second gear in meshed relation with said first gear, friction plates for variably engaging the sides of said second gear, a shaft supporting said second gear and friction plates, said friction plates being rotatable with and said second gear being rotatable relative to said last named shaft, idler rollers for unrolled portions of the web, at least one of said idler rollers being vertically movable, counterbalancing means for said movable roller, and means responsive to movements of said movable roller for actuating said friction plates relative to said second gear.

3. In a machine of the type described having a roller for carrying a web in rolled form, a shaft secured to said roller, a first gear rotatable with said shaft, a second gear in meshed relation with said first gear, friction plates for variably engaging the sides of said second gear, a shaft supporting said second gear and friction plates, said friction plates being rotatable with and said second gear being rotatable relative to said last named shaft, idler rollers for unrolled portions of the web, at least one of said idler rollers being vertically movable, counterbalancing means for said movable roller, an air pressure diaphragm and a linkage system for actuating said friction plates relative to said second gear, means for connecting said diaphragm to an external source of air pressure, means including a valve for controlling air pressure from said source on said diaphragm, and means for actuating said valve in response to movements of said movable roller.

4. In a machine as defined by claim 3 wherein the counterbalancing means includes a rotatable shaft and the valve includes a valve stem connected to said shaft.

5. A tensioning unit for a web winding and unwinding machine comprising a pair of spaced frame members; spaced horizontal idler rollers between said members; said members having vertical slots therein; movable members slidably mounted in said slots; a roller journaled in said movable members; counterbalancing means for said movable members and journaled roller, said counterbalancing means including counterweights, a pulley, and a flexible member on said pulley connecting said weights to the movable roller; a shaft rotatable with the pulley; and a valve having a rotatable stem connected to said shaft.

6. A tensioning unit for a web winding and unwinding machine comprising a pair of spaced frame members; spaced horizontal idler rollers between said members, said members having vertical slots therein; movable members slidably mounted in said slots; a roller journaled in said movable members; counterbalancing means for said movable members and journaled roller, said counterbalancing means including counterweights, a pulley and a flexible member on said pulley connecting said weights to the movable roller; a shaft rotatable with the pulley; a valve having a rotatable stem connected to said shaft; and a dash pot between said movable roller and said frame members.

7. A tensioning unit for a web winding and unwinding machine comprising a pair of spaced frame members; spaced horizontal idler rollers between said members, said members having vertical slots therein; movable members slidably mounted in said slots; a roller journaled in said movable member; vertical racks adjacent the slots; pinions rotatably mounted on the journaled roller; said pinions being in meshed relation with the said racks; counterbalancing means for said movable members and journaled roller, said counterbalancing means including counterweights, a pulley and a flexible member on the said pulley connecting said weights to the movable roller; a shaft rotatable with the pulley; and a valve having a rotatable stem connected to said shaft.

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