TENSIONING DEVICE

Filed Jan. 30, 1956 4 Sheets-Sheet 1

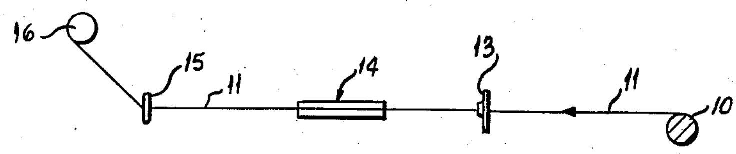

Fig-1

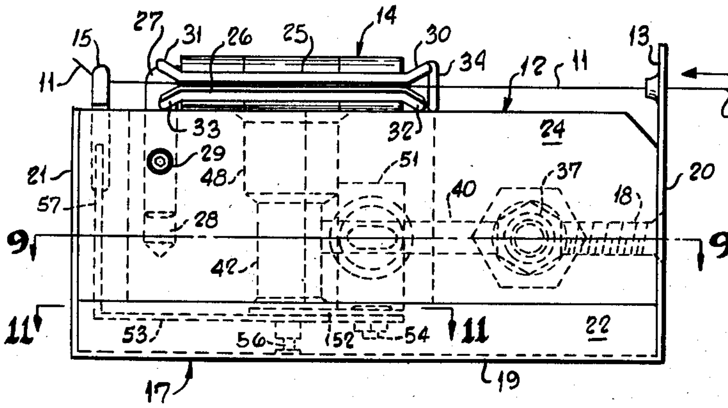

Fig-2

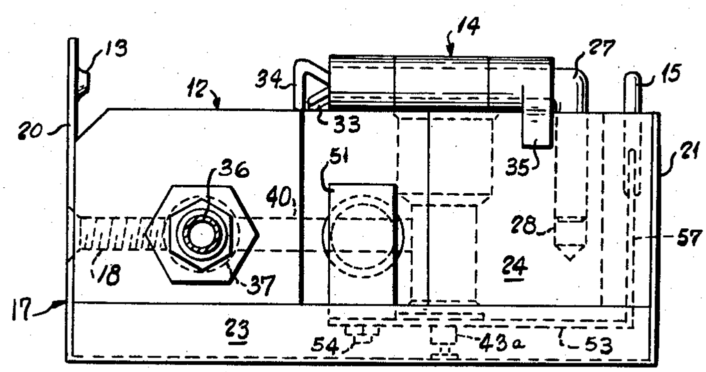

Fig-3

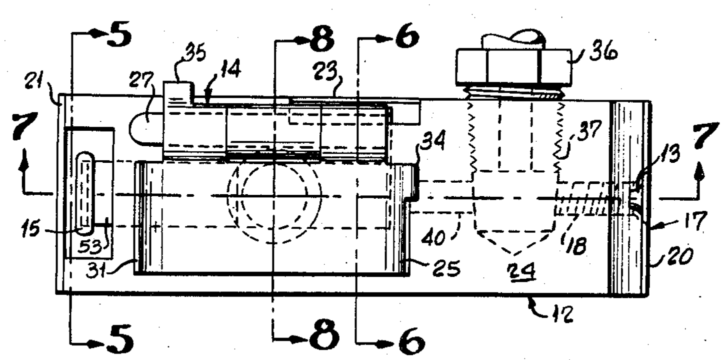

Fig-4

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TENSIONING DEVICE

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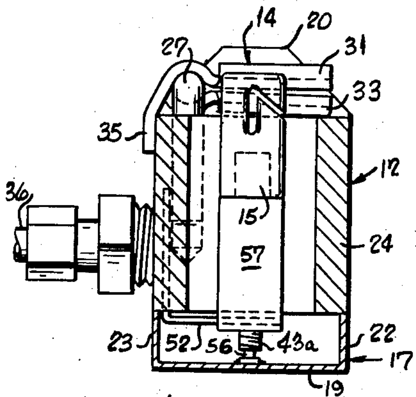

Fig-5

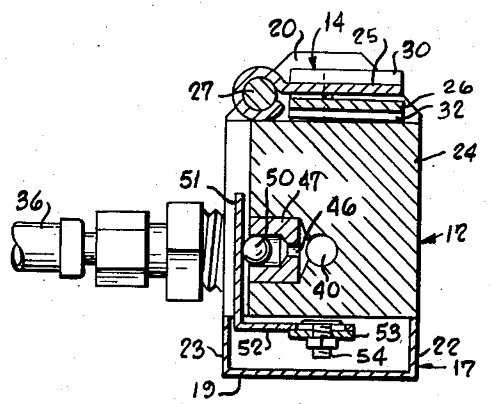

Fig-6

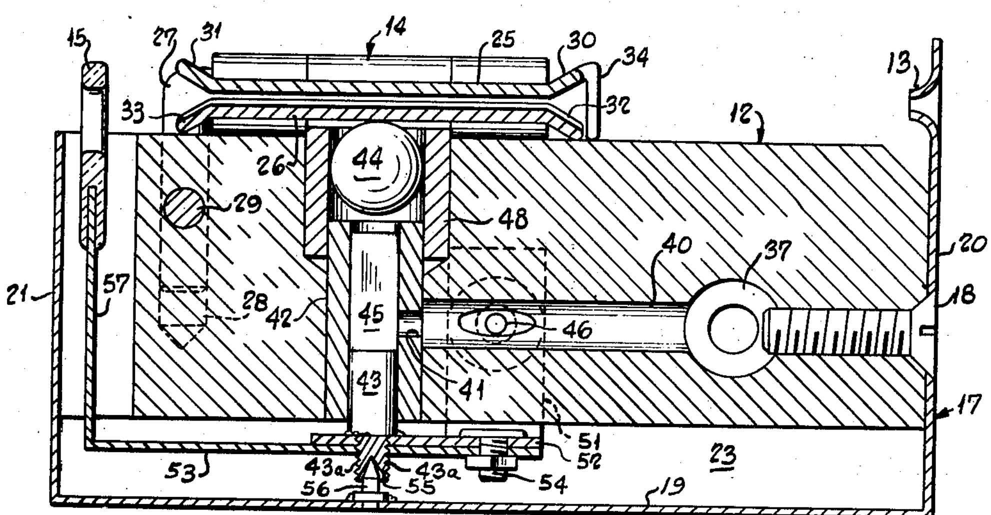

Fig-7

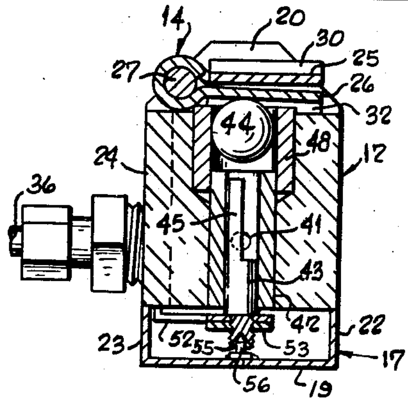

Fig-8

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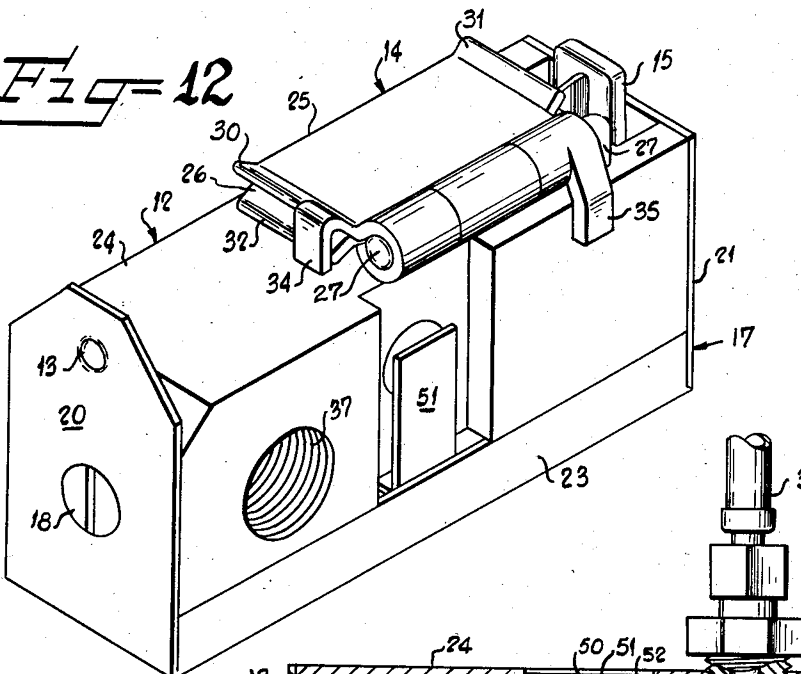
Fig-12



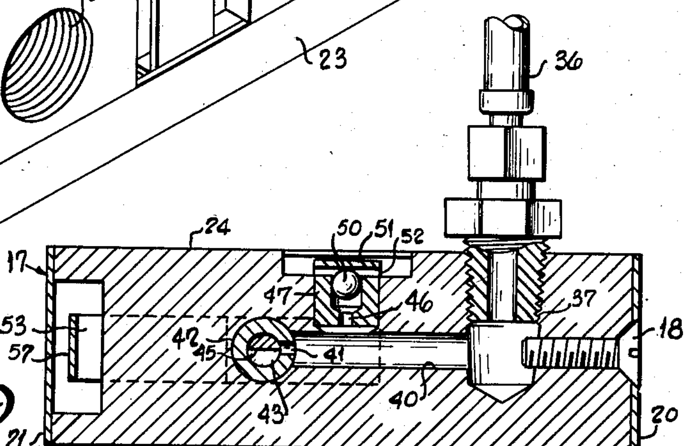
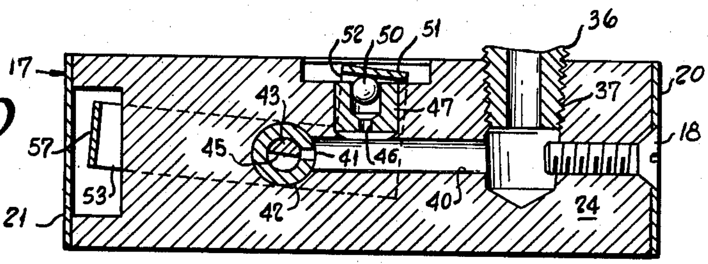


Fig-9

Fig-10



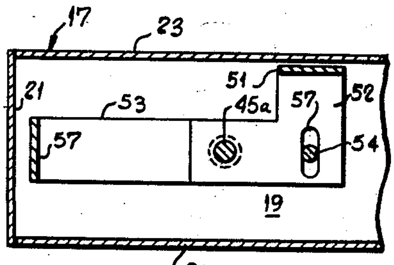


Fig-11

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TENSIONING DEVICE

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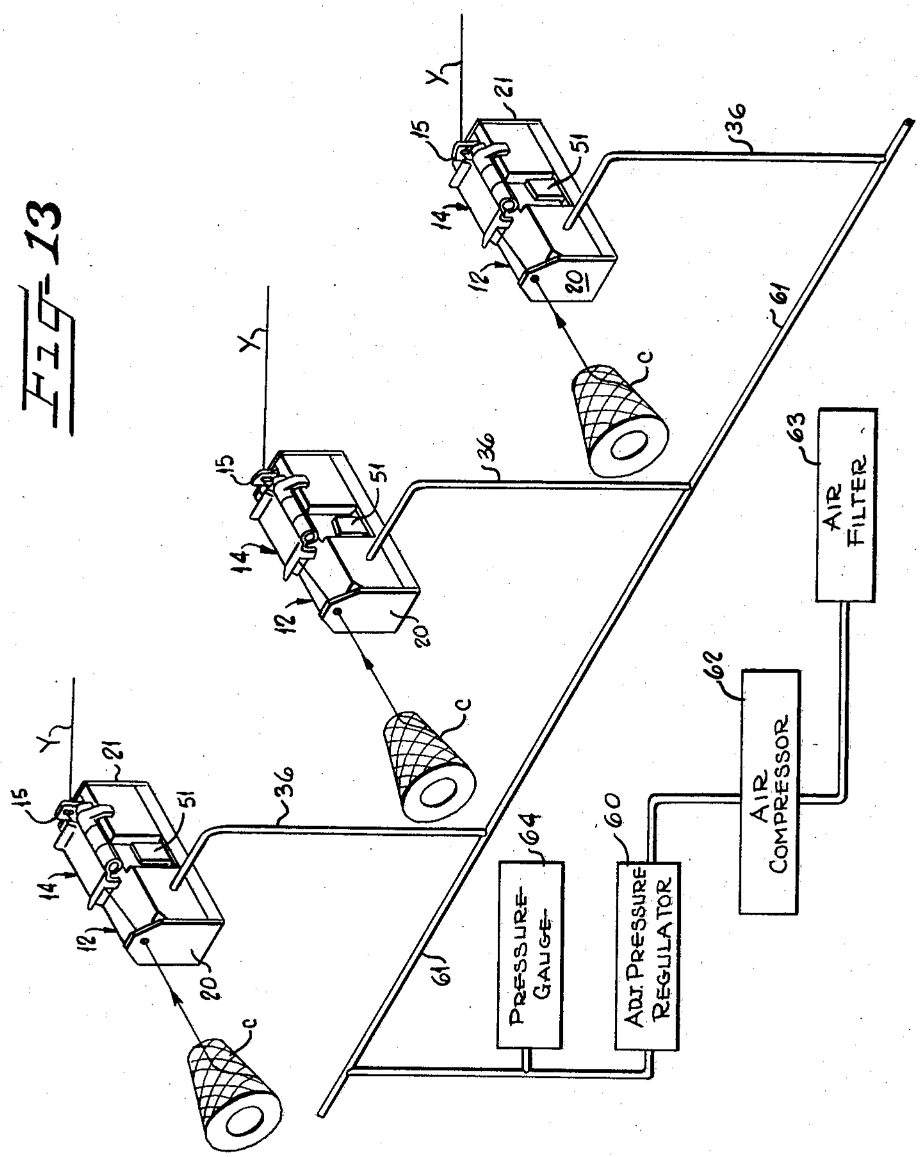
FIG-13



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TENSIONING DEVICE

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Application January 30, 1956, Serial No. 562,118

17 Claims. (Cl. 242—45)

This invention relates to tensioning devices and more particularly to a tensioning device for tensioning an indefinite length strand of material such as a moving textile yarn wherein it is desired to maintain a predetermined tension on the yarn at all times.

It is an object of the invention to provide a tensioning device wherein the device maintains a predetermined tension on the traveling strand at all times by automatically compensating for any increase or decrease in strand tension by automatically varying the frictional drag on the strand passing through the device.

It is a more specific object of the invention to provide a tension device having a pair of tension plates between which the traveling strand passes and which plates place the traveling strand under a predetermined tension when the strand is running at optimum conditions and means controlled by the moving strand are provided for varying the tension exerted on the strand by the tension plates to compensate for any variance in the tension of the strand as the same leaves the device.

It is another object of the invention to provide a tension device having an actuating lever adapted to be pivoted by the traveling strand material if the tension in the strand leaving the device becomes too great and a thrust lever connected to the actuating lever to counter-balance the movement of the actuating lever to return the same to its normal position upon the tension in the strand leaving the device being restored to the desired amount.

It is also a further object of the invention to provide a strand tensioning device whereby a plurality of the same may be connected in series to a fluid line to permit the tension exerted on the traveling strands to be varied by merely varying the pressure in the main line connected to the tensioning devices. This feature is particularly important where it is desired to change over the size or diameter of the strand running through the device which necessitates a change in the tension. Also, the variance of twist in yarns will sometimes necessitate the changing of the tension.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

Figure 1 is a schematic illustration of a traveling strand of material passing through the tensioning device;

Figure 2 is a front elevation of the tensioning device;

Figure 3 is a rear elevation of the tensioning device;

Figure 4 is a top plan view of Figure 2;

Figure 5 is a vertical sectional view taken on line 5—5 in Figure 4, and clearly showing the actuating arm of the tensioning device;

Figure 6 is a vertical sectional view taken on line 6—6 of Figure 4 and clearly showing the thrust piston for maintaining the actuating arm in a balanced running position;

Figure 7 is an enlarged vertical sectional view taken on line 7—7 of Figure 4;

Figure 8 is a vertical sectional view taken on line 8—8 of Figure 4 and showing the throttling valve which controls the movement of the lower tensioning plate with respect to the upper tensioning plate to tension the yarn passing therebetween;

Figure 9 is a horizontal sectional view taken on line 9—9 of Figure 2 and showing the position of the throttling valve, thrust piston and actuator arm with the strand running at optimum conditions;

Figure 10 is a view similar to Figure 9 with the parts rearranged to compensate for the yarn tension becoming too great between the tension device and take-up means.

Figure 11 is a horizontal sectional view taken on line 11—11 of Figure 2 and showing the manner in which the actuating arm is connected to the thrust arm;

Figure 12 is a perspective view of the tensioning device;

Figure 13 is a diagrammatic view of a plurality of yarn packages as in a creel and showing the invention applied thereto.

Referring more specifically to the drawings and particularly Figure 1, reference numeral **10** indicates a let-off roll from which an indefinite length of strand material **11** is being unwound which passes through a rear or inlet stationary guide **13** of a tension device broadly indicated by reference numeral **12** (Figure 12) and between a pair of friction or tension plates **14** and through a pivotable front or outlet strand guide **15** after which the strand material is wound on a take-up roll **16**. The tension device **12** must be positioned at an angular relation to the take-up roll **16** to permit the strand material **11** to move the guide **15** in the direction of the take-up roll **16** for relieving excessive tension on the strand material.

The tension device **12** as shown in Figure 2 has a substantially U-shaped casing broadly indicated at **17** which casing comprises an upright front member **20** and an upright rear member **21**, which are connected together by a bottom plate **19**. The stationary strand material guide **13** is secured in the upper portion of the front member **20**. Side flanges **22** and **23** extend a short distance above the bottom plate **19** and support a body portion **24** which is secured inside the casing **17** by a screw **18** penetrating the front member **20**.

The tension plates **14** comprise an upper stationary plate **25** and a lower pivotally or hingedly mounted plate **26**, both of which plates are mounted on top of the body portion **24** by an L-shaped tension plate anchor pin **27** which has one end positioned in a vertical bore **28** (Figure 7) provided in the body portion **24** and the same secured therein by a screw or clamping member **29**. The upper tension plate **25** is provided with upwardly and outwardly turned or flared front and rear ends **30** and **31** and the bottom tension plate **26** is provided with outwardly and downwardly flared front and rear ends **32** and **33** to facilitate the threading of the strand material **11** in the device and to eliminate any sharp edges on the tensioning plates in the path of travel of the strand material between the plates.

To maintain the upper tension plate **25** stationary, the front end **30** of the tension plate **25** is provided with a depending vertical flange **34** the lower end of which rests against the upper surface of the body portion **24** to prevent the plate from moving downwardly relative to the body portion **24**. A depending flange member **35** extends from one side of the plate **25** and engages one side of the body portion **24** to prevent the tension plate **25** from moving upwardly. The flange member **34** also serves as a guide for the strand material **11** passing between the tension plates to maintain the same in substantially the medial portion of the tension plates during its passage therebetween.

For actuating the lower tension plate **26** or to move the same upwardly towards the stationary plate **25**, fluid actuated means are employed for engaging the bottom surface or the underside of the lower tension plate 26. Reference numeral 36 indicates a fluid line leading from a suitable outside source of compressed fluid (preferably air) into the body portion 24 by the line being connected to a transverse passageway 37 provided in a side wall of the body portion 24. The passageway 37 is communicatively connected to a longitudinally extending passageway 40 from which the fluid flows through an aperture 41 provided in a bushing 42 which surrounds a throttling valve 43. Fluid upon entering the confines of the bushing 42 will be directed upwardly against a throttling piston 44 in the form of a steel ball which piston 44 engages the undersurface of the lower tension plate 26 to move the same upwardly to maintain the strand material traveling between the tension plates under the desired tension.

It will be observed in Figures 7, 9 and 10 that the valve 43 is a pin sleeve type of valve having half of the upper portion cut away as at 45 to permit the valve by pivotal movement to regulate the amount of air coming through the aperture 41 in the bushing 42 from the passageway 40. The provision of the bushing 42 surrounding the valve 43 permits the valve to be operated with a minimum of friction and also provides a seat or rest for the piston 44 when the same is in its lowermost position. It will be observed in Figure 7 that in the absence of compressed fluid forcing the piston 44 in the position shown therein the same would normally rest on top of the bushing 42 and during actuation the piston 44 is guided in a bushing or cylinder 48 having an internal diameter of substantially the same as the diameter of the piston 44.

A lateral passageway 46 is communicatively connected to the passageway 40 and is defined by a bushing 47 in which is positioned a thrust piston 50 in the form of a steel ball which in normal operation presses against an upright leg 51 extending from and formed integral with a substantially L-shaped thrust lever or arm 52 as shown more clearly in Figure 11. A substantially L-shaped actuating lever or arm 53 is secured to the thrust lever 52 by a fastener or bolt 54 (Figure 7). The actuating lever 53 is provided with an upright end 57 to the upper end of which is secured the front or outlet guide 15. It will be observed in Figure 11 that the thrust lever 52 is provided with an elongated slot or aperture 57 for manually adjusting the angular relationship of the thrust lever 52 relative to the actuating lever 53. Under most operations, it is preferable to have the thrust lever 52 in longitudinal alinement with the actuating lever 53 as shown in Figure 11.

For fixedly securing the thrust and actuating levers 52, 53 to the valve 43, the valve is provided with a threaded reduced portion 43*a* on its lower end which threadedly receives the thrust and actuating levers 52, 53 respectively. It is apparent that there is no relative movement between the valve 43 and the thrust and actuating levers during operation. Any pivotal movement imparted to the actuating lever by the traveling strand is imparted to the valve 43. For maintaining the valve 43 inside the bushing 42, a recessed portion 55 is provided in the lower end of the reduced portion 43*a* in which is received a pointed supporting pivot pin 56 which is fixedly secured to the bottom 19 of the casing 17.

Under normal running conditions, the actuating lever 53 and thrust lever 52 will be in the position shown in Figure 9 and the strand material 11 passing through the tensioning device will have the desired tension applied thereto by the lower tension plate 26 being urged slightly upwardly towards the upper stationary tension plate 25 to apply friction on the material passing therebetween. In this position, the compressed fluid entering the body portion 24 will be directed through the aperture 41 in the bushing 42 to move the throttling piston 44 upwardly into engagement with the lower tension plate 26. As will be observed in Figure 9, under the optimum running condition, the valve 43 will be positioned to partially close the aperture 41 and maintain a lower rate of flow of the fluid into the confines of the bushing 42. During the optimum running condition compressed fluid will also be directed into the passageway 46 to move the thrust piston 50 into engagement with the upright lever 51 of the thrust lever 52.

Under all operating conditions, the compressed fluid is always being bled or permitted to escape past the throttling piston 44 to prevent the building up of excessive pressures. During operation, the tensioning device will automatically balance itself by the force of the thrust piston 50 on the thrust lever 52 counterbalancing the pivoting effect of the strand material 11 on the actuating lever 53. For example, if the tension on the strand material 11 after leaving the tension device is suddenly increased, the strand material passing through the front guide 15 will move the actuating lever 53 towards the take-up roller 16 (Figure 1) which movement will pivot the valve 43 clockwise to reduce the amount of compressed fluid entering the aperture 41 in the bushing 42 (Figure 10). This lowers the pressure of the throttling piston 44 on the lower tension plate 26, to thus reduce the tension on the strand material 11 at this point and thus permit the thrust piston 50 to quickly return the actuating lever 53 from the position shown in Figure 10 to the optimum running position shown in Figure 9.

If the tension on the strand material beyond the tensioning device suddenly decreases, the tension on the strand material 11 will remain uniform since the actuating lever 53 will be moved counterclockwise or to a position opposite from that shown in Figure 10 and the valve 43 will be pivoted to permit more air to enter aperture 41 to increase the tension on the strand material passing between the tension plates to thus compensate for the lowering of the tension beyond the tension device. In a short interval of time, the yarn will pull the actuating lever 53 to the position shown in Figure 9 and the tension device will again be in balanced positioned wherein the force of the thrust piston 50 counterbalances the pivotal thrust of the strand material 11 on the actuating lever 53.

It is apparent that under all running conditions, the strand of material 11 leaving the tensioning device is kept under a uniform tension since the tension device will automatically compensate for any varying condition of the strand tension by automatically varying the frictional engagement of the tension plates 25 and 26 on the strand material.

In Figure 13 is schematically illustrated a plurality of identical yarn tension devices 12 employed in series to control the tension of yarn Y being taken off cones C mounted in a creel (not shown) and collected on a common take-up means such as a warp beam (not shown). The yarn tension can be increased or decreased simultaneously at all of the units by adjusting the pressure regulator 60 to control the pressure in the main line 61 connecting each fluid line 36 to the devices 12. An air compressor 62 provided with a filter 63 supplies the pressure requirements for the system. A pressure gauge 64 is connected to the main line 61 which gauge can be calibrated to read directly in units of yarn tension such as grams if so desired. Thus, by observing the gauge 64 and by adjusting the regulator 60, the operator can provide any desired yarn tension in all the strands simultaneously and uniformly.

Although the invention has been described in association with a strand material, the invention is not restricted to such material and may readily be employed in tensioning any type of indefinite length material such as wires, electrical conductors, or the like. Also, although air has been disclosed as the preferred fluid for actuating the respective pistons, any type of fluid may be employed in either liquid or gaseous state.

Accordingly, it will be apparent that there has been provided a novel fluid actuated tensioning device wherein the traveling strand material controls the position of the throttling valve to vary the tension exerted on the strand material passing through the device and wherein the strand material leaving the tensioning device is maintained under a constant tension by the tensioning device automatically compensating for any increase or decrease in tension on the strand material beyond the tensioning device.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

We claim:

1. In a tension device for a strand material, means for resisting the movement of the strand material through the tension device to cause tension on the strand material, fluid actuated means acting on the resisting means to cause the latter to apply resistance to the strand material, a valve for controlling said fluid actuated means, and means operatively connected to said valve and positioned in spaced relation to said resisting means and engageable by the strand material after it passes said resisting means, said latter means being responsive to the tension in the strand material after passing said resisting means for controlling the valve whereby pressure exerted by the fluid actuated means is varied in accordance with variations in the tension of the strand material leaving the resisting means to maintain the tension on the strand material substantially constant.

2. A tension device for a moving strand material comprising means for resisting the movement of the strand material through the tension device to cause tension to be applied thereto, fluid actuated means acting on the resisting means to apply resistance to the strand material, valve means for controlling the supply of fluid under pressure to the said fluid actuated means, a pivotally mounted actuating lever for guiding the traveling strand material as it leaves the device, said lever being operatively secured to said valve for varying the fluid supplied to the said fluid actuated means to maintain the tension in the strand material substantially constant, and a fluid actuated thrust lever connected to said actuating lever for exerting a counterbalancing force on said actuating lever thereby resisting the pivotal movement of the same.

3. In a tension device for a strand material, means for resisting the movement of the strand material through the tension device to cause tension to be applied thereto, fluid actuated means acting on the resisting means to cause the latter to apply resistance to the strand material, a valve for controlling said fluid actuated means, and a pivotable actuating lever operatively connected to said valve and positioned in spaced relation to the resisting means and dependent on the tension in the strand material after passing the said resisting means for controlling the valve whereby pressure exerted by the fluid actuated means is varied in accordance with variations in the tension of the strand material leaving the resisting means to maintain the tension on the strand material substantially constant at all times.

4. A tension device for a moving strand material comprising means for resisting the movement of the strand material through the tension device to cause tension to be applied thereto, fluid actuated means acting on the resisting means to apply resistance to the strand material, a valve for controlling the supply of fluid under pressure to said fluid actuated means, a pivotally mounted strand guide engaged by the strand material and being operatively connected to said valve for varying the pressure of the fluid supplied to said fluid actuated means to maintain the tension in the strand material substantially constant at all times, and said strand guide being positioned in spaced relation in front of said strand resisting means to receive the traveling strand material after the tension is applied thereto.

5. In a tension device for a strand material, means for resisting the movement of the strand material through the tension device to cause tension on the strand material, fluid actuated means acting on the resisting means to cause the latter to apply resistance to the strand material, a valve for controlling said fluid actuated means, a pivotable actuating lever adapted to be engaged by the strand material and positioned in spaced relation to the resisting means and dependent on the tension in the strand material after passing the said resisting means for controlling the valve whereby pressure exerted by the fluid actuated means is varied in accordance with variations in the tension of the strand material leaving the resisting means, and means for counterbalancing the pivotal movement of the actuating lever.

6. A tension device for a moving strand material comprising means for resisting the movement of the strand material through the tension device to cause tension to be applied thereto, fluid actuated means acting on the resisting means to apply resistance to the strand material, a valve for controlling the supply of fluid under pressure to the said fluid actuated means, a pivotally mounted strand guide connected to said valve for varying the fluid supplied to the said fluid actuated means to maintain the tension in the strand material leaving the device substantially constant, and means for constantly bleeding the fluid from the device to prevent the building up of excessive pressure.

7. A tension device for a moving strand material comprising a pair of tension plates for resisting the movement of the strand material through the tension device, said tension plates comprising an upper stationary plate and a lower pivotally mounted plate adapted to be moved upwardly relative to the upper plate, fluid actuated means acting on the lower tension plate to cause the latter to be moved upwardly to apply resistance to the traveling strand, valve means for controlling the amount of fluid to said fluid actuated means, strand guide means positioned adjacent the pair of tension plates for guiding the strand material as the same leaves the tension device, and means operatively connecting said strand guide to said valve whereby the moving strand controls the movement of the valve for varying the fluid supplied to the means engaging the lower tension plate to maintain the strand material leaving the device at a substantially constant tension.

8. In a tension device for a moving strand material wherein the strand leaves the tension device at an angle, the combination of a stationary rear strand guide, a pair of tension plates, said tension plates comprising an upper stationarily positioned tension plate, and a lower pivotally mounted tension plate, a pivotally mounted actuating arm having a front strand guide in the upper portion thereof, a valve operatively secured to said actuating arm, a passageway directing fluid under pressure to said valve, a throttling piston positioned above said valve and adapted to be moved by said fluid into engagement with the bottom surface of the lower tension plate to cause upward movement of said lower tension plate, an auxiliary passageway communicatively connected to said passageway leading to said valve, a thrust piston positioned in the outer end of said auxiliary passageway, a thrust arm positioned adjacent said thrust piston and operatively secured to said actuating arm, and said thrust piston exerting a predetermined thrust on said thrust arm to counterbalance the force on the actuating arm by the moving strand material under normal running conditions.

9. In a tension device according to claim 8 wherein said throttling piston and thrust piston are in the form of steel balls, and said valve is in the form of a pin vertically positioned immediately below said throttling piston and below said lower tension plate.

10. In a fluid controlled tension device for a traveling strand material, the combination of fluid actuated means for frictionally resisting the passage of the strand material through the device, a pivotal valve for controlling the amount of frictional resistance applied to the strand material, a pivotally mounted actuating lever adapted to be engaged by the strand material and positioned in spaced relation to said fluid actuated means and connected to said valve to control the movement of the valve, the tension in the strand material leaving the tension device controlling the position of the actuating lever, a fluid actuated thrust lever operatively connected to said actuating lever for exerting a counterbalancing force on the actuating lever to compensate for the thrust imparted to the actuating lever by the moving strand material under normal running conditions, said valve controlling the counterbalancing force of the thrust lever, and means for constantly bleeding the fluid from the tension device whereby fluid pressure is prevented from building up therein to maintain the pressure in the tension device substantially constant at all times.

11. In a fluid controlled tension device for a traveling strand material, the combination of fluid actuated means for frictionally resisting the passage of the strand material through the device, valve means for controlling the amount of frictional resistance applied to the strand material, a pivotally mounted actuating lever connected to said valve, the tension in the strand material leaving the tension device controlling the position of the actuating lever, a thrust lever operatively connected to said actuating lever for exerting a counterbalancing force on the actuating lever to compensate for the thrust imparted to the actuating lever by the moving strand material under normal running conditions, said valve controlling the counterbalancing force of the thrust lever and being connected thereto, and means for constantly bleeding the fluid from the tension device whereby fluid pressure is prevented from building up therein to maintain the pressure in the tension device substantially constant at all times.

12. A tension device for a traveling strand material comprising means for frictionally resisting the passage of the strand material through the device, a valve for controlling the amount of frictional resistance applied to the strand material, a pivotally mounted actuating lever adapted to be engaged by the strand material and positioned in spaced relation to said means for frictionally resisting the passage of the strand material and being connected to said valve, the tension in the strand material leaving the tension device controlling the position of the actuating lever, and means for exerting a counterbalancing force on the actuating lever to compensate for the pivotable movement imparted to the lever by the moving strand material under normal running conditions.

13. In a tension device for a traveling strand material wherein the strand leaves the device at an angle, the combination of a body portion, a pair of superposed tension plates mounted on said body portion for applying tension to the strand material, the upper tension plate being stationarily positioned, the lower tension plate being pivotally mounted and adapted to be moved toward the upper plate, a valve positioned below said tension plates, a cylinder above said valve, a piston positioned in said cylinder, a passageway communicatively connected to said valve and cylinder to permit the entering of fluid under pressure to move the piston into frictional contact with the lower tension plate, a lever positioned in front of said tension plates for guiding the strand leaving the device, and said lever being connected to said valve for controlling the frictional resistance imparted to the strand by said tension plates.

14. In a tension device according to claim 13 wherein means are connected to said lever for counterbalancing the thrust imparted to the lever by the traveling strand, and means are provided for bleeding the fluid from the body portion to prevent the building up of excessive pressures.

15. In a tension device for a traveling strand material, the combination of a body portion, a pair of superposed tension plates mounted on said body portion for applying tension to the strand material, a valve positioned below said tension plates, a cylinder above said valve, a piston positioned in said cylinder, a first passageway communicatively connected to said valve and cylinder to permit the entering of fluid under pressure to move the piston into frictional contact with the lower tension plate, a pivotally mounted actuating lever positioned in the path of travel of the strand material immediately following its passage between the tension plates, said lever being connected to said valve for controlling the frictional resistance imparted to the traveling strand material, a thrust lever connected to said actuating lever, a second passageway communicatively connected to said first passageway, and a fluid actuated piston positioned in the outer end of said second passageway and adapted to engage the thrust lever whereby the thrust lever counterbalances any movement imparted to the actuating lever by the strand material.

16. In a device according to claim 15 wherein said pistons are in the form of spherical balls, and said valve in the form of a pin.

17. A tension device for a moving strand material comprising a pair of tension plates for resisting the movement of the strand material through the tension device, said tension plates comprising an upper plate and a lower shiftably movable plate adapted to be moved upwardly relative to the upper plate, fluid actuated means acting on the lower tension plate to cause the latter to be moved upwardly to apply resistance to the traveling strand, valve means for controlling the amount of fluid to said fluid actuated means, strand guide means positioned adjacent the pair of tension plates for guiding the strand material as the same leaves the tension device, and means operatively connecting said strand guide to said valve whereby the moving strand controls the movement of the valve for varying the fluid supplied to the means engaging the lower tension plate to maintain the strand material leaving the device at a substantially constant tension.

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