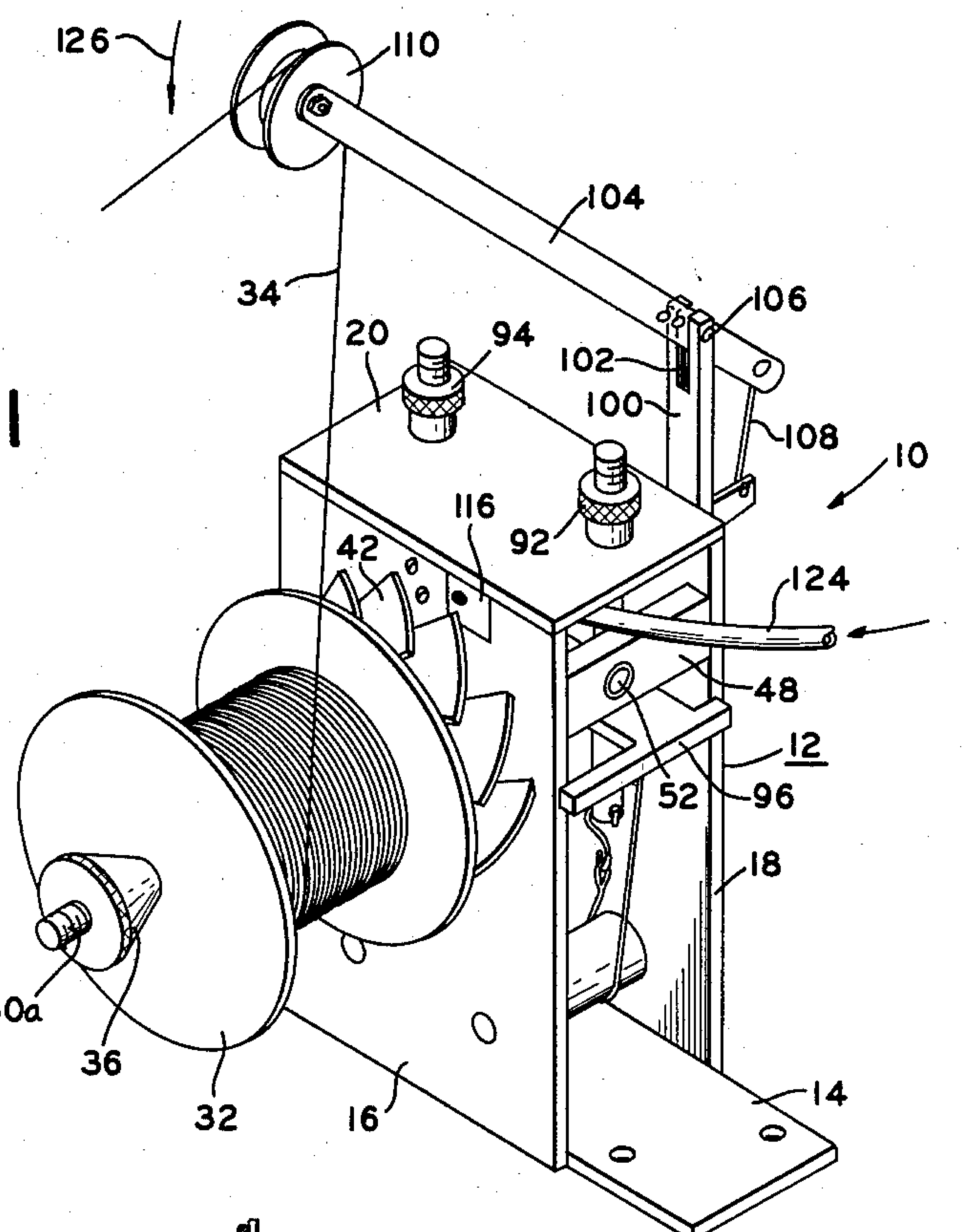
Aug. 27, 1963 T. S. BARTLETT 3,101,912

TENSIONER

Filed Aug. 24, 1961 2 Sheets-Sheet 1

FIG. 1



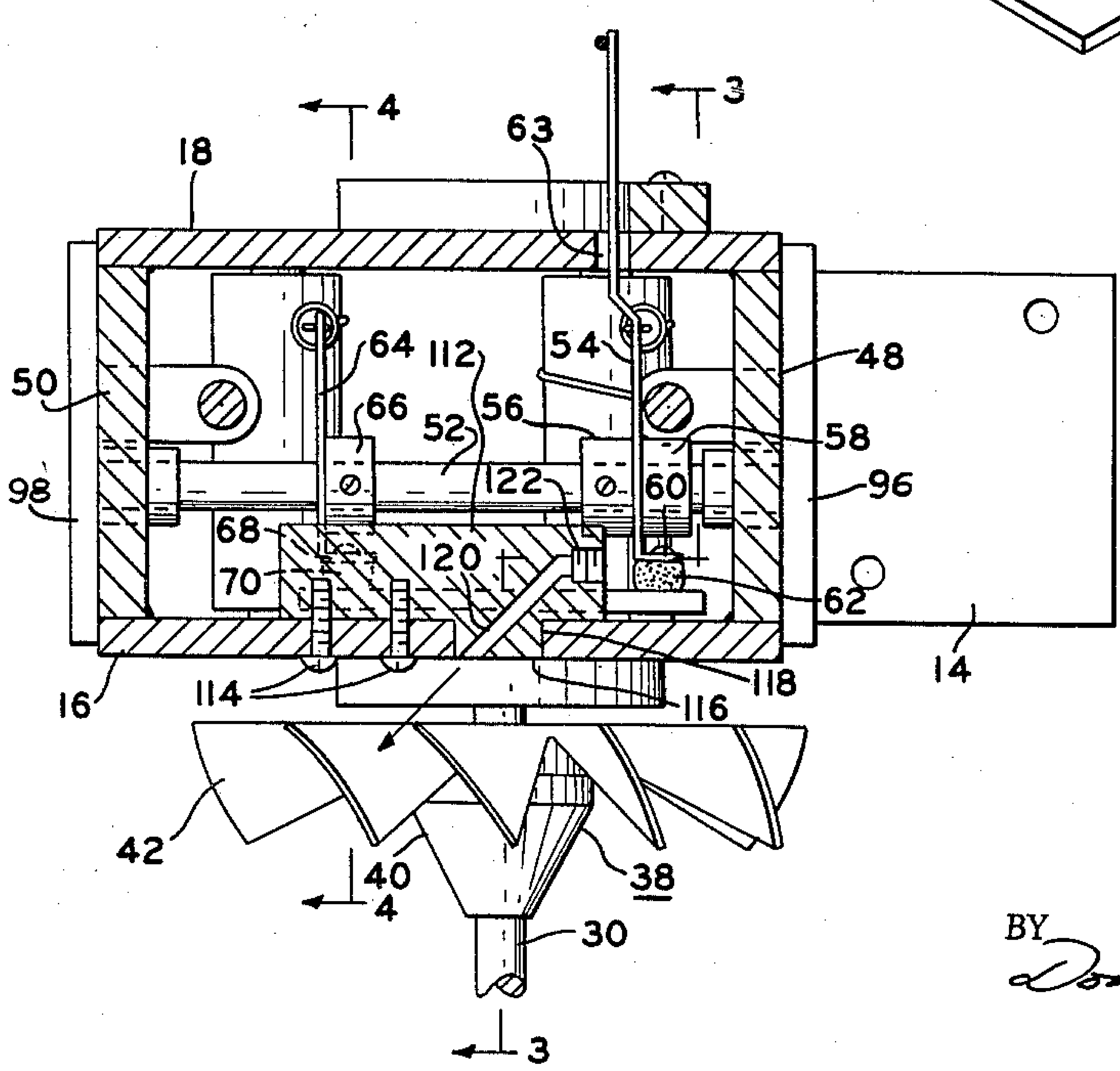


FIG. 2

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Aug. 27, 1963 T. S. BARTLETT 3,101,912

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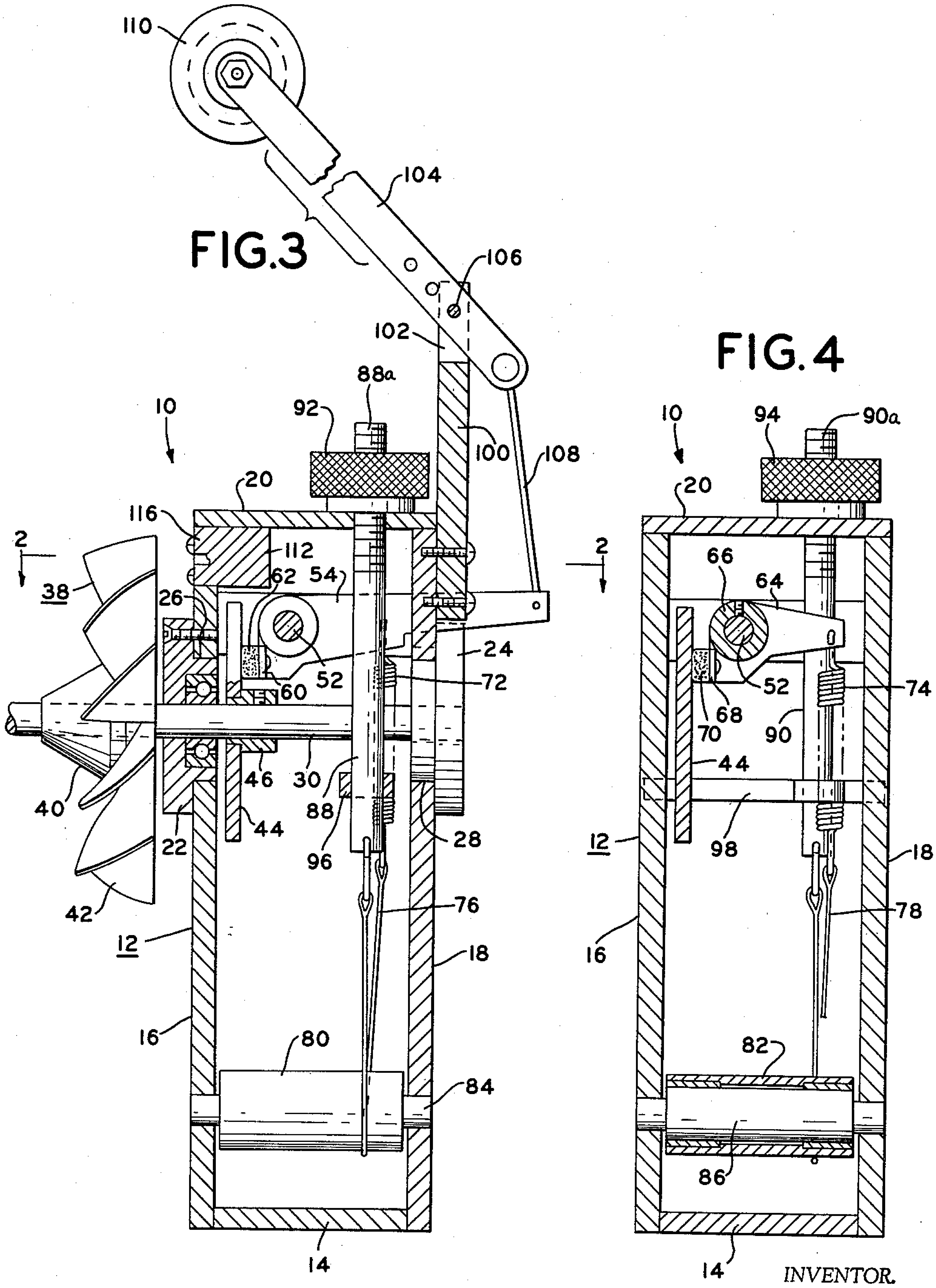
Filed Aug. 24, 1961 2 Sheets-Sheet 2



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1

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TENSIONER

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The present invention relates to a tensioner, and more particularly to a tensioner for controlling the tension applied to a continuous filament, such as a thread or wire, as it is de-reeled from a spool.

In the winding of a continuous filament, such as a thread or wire, on a rotating spool or bobbin, it is desirable to maintain a uniform tension on the filament to achieve a smooth winding. The amount of tension which can be applied to the filament without breaking the filament depends on the thickness of the filament and the strength of the material of the filament. Thus, the tension which can be applied to very fine filaments is much less than that which can be applied to heavier filaments. Also, the uniformity of the tension applied to fine filaments is more critical than that applied to the heavier filaments.

When winding a spool or bobbin with multiple layers of a filament, the linear speed of the filament to the spool is continuously increased as the layers build up on the spool. To increase the linear speed of the filament an increase in the force applied to the filament is necessary, which increases the tension on the filament. Therefore, to prevent the tension on the filament from increasing to a point where the filament is broken, it is necessary to use some means for controlling the tension. A device generally used for this purpose includes a rotating shaft on which the supply spool of the filament is mounted, and either a brake or slip clutch for controlling the speed of rotation of the shaft and the supply spool. The brake or slip clutch is operated by the filament itself so that as the tension on the filament increases, the brake or slip clutch is released to permit faster rotation of the supply spool and thereby reduce the tension. As the tension on the filament decreases, the brake or slip clutch is engaged to slow down the speed of rotation of the supply spool.

A device commonly used for controlling the operation of the brake or slip clutch is a control arm pivotally mounted between its ends and operatively connected to the brake or slip clutch. A spring means is connected to one end of the arm to achieve a desired tension setting, and the filament passes over the other end of the arm. Thus, when the tension on the filament increases, the arm is pivoted in one direction to release the brake or slip clutch. When the tension on the filament decreases, the spring means pivots the arm in the other direction to engage the brake or slip clutch. However, the tensioner of this type heretofore used has a number of disadvantages.

One disadvantage arises from the fact that when the brake is released to permit a reduction in the tension on the filament, the weight of the supply spool must be overcome before the speed of the supply spool is increased sufficiently to reduce the tension. Thus, the increased force applied to the filament must be maintained for a period of time after the brake is released to cause the speed of rotation of the supply spool to increase. This results in a delay in the action of the tensioner which is undesirable, particularly when winding fine filaments at high speeds. Also, this causes a relatively large fluctuation in the tension from the desired tension, which is undesirable. Large fluctuations in the tension on the filament can cause poor windings, and increases the possibility of breaking the filament.

It is an object of the present invention to provide a novel tensioner.

It is another object of the present invention to provide

2

a novel tensioner for controlling the tension applied to a continuous filament as it is dereeled from a spool.

It is still another object of the present invention to provide a dereeling tensioner for a filament which operates with a minimum delay, and which achieves an improved uniformity of tension.

It is a further object of the present invention to provide a novel power driven dereeling tensioner for a filament.

It is a still further object of the present invention to provide a pneumatically driven dereeling tensioner for a filament.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a perspective view of the dereeling tensioner of the present invention.

FIGURE 2 is a horizontal sectional view across the top portion of the tensioner of the present invention.

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 2.

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 2.

Referring to the drawings, the tensioner of the present invention is generally designated as **10**.

Tensioner **10** comprises a casing, generally designated as **12**. Casing **12** comprises a base plate **14**, a pair of parallel side plates **16** and **18** extending upright from opposite side edges of the base plate **14**, and a top plate **20** secured across the top edges of the side plates **16** and **18**. A pair of bearings **22** and **24** are mounted in horizontally aligned openings **26** and **28** in the side plates **16** and **18** respectively. A horizontal shaft **30** is rotatably supported in the bearings **22** and **24**. As shown in FIGURE 1, shaft **30** extends beyond the front side plate **16** of the casing **12**, and is adapted to support the supply spool **32** of the filament **34**. The free end **30***a* of the shaft **30** is threaded, and a conical nut **36** is threaded on the end **30***a* of the shaft **30** with the smaller diameter end of the nut **36** engaging the side of the supply spool **32**.

An impulse wheel, generally designated as **38**, is mounted on the shaft **30** adjacent the outer surface of the front side plate **16** of the casing **12**. Impulse wheel **38** comprises a hub **40**, and a plurality of blades **42** circumferentially spaced around the hub **40** and extending radially outwardly therefrom. The hub **40** has a conical end portion which is adapted to engage the side of the supply spool **32**. As shown in FIGURE 3, a flat brake disc **44** is mounted on the shaft **30** within the casing **12** and adjacent the inner surface of the front side plate **16**. Brake disc **44** is mounted on a hub **46** which surrounds and is secured to the shaft **30**.

As shown in FIGURES 1 and 2, a pair of end bars **48** and **50** extend between and are secured to the side plates **16** and **18** at the opposite end edges thereof. The end bars **48** and **50** are in horizontal alignment, and are positioned adjacent and parallel to the top plate **20**. A horizontal shaft **52** extends between and is supported by the end bars **48** and **50**. Shaft **52** is parallel to the side plates **16** and **18**, and is positioned closer to the front side plate **16** than to the back side plate **18**. As shown in FIGURES 2 and 3, a brake arm **54** is rotatably mounted on the shaft **52** adjacent the front end of the brake arm. Brake arm **54** is positioned on the shaft **52** adjacent the peripheral edge of the brake disc **44**, and to one side of the supply spool shaft **30**. The brake arm **54** is secured in position on the shaft **52** by a pair of collars **56** and **58** which are secured to the shaft **52** and sandwich the brake arm **54** therebetween. The front end of the brake arm 54 extends below the shaft 52, and is bent to provide a flange 60 which is adjacent and parallel to the brake disc 44. A brake shoe 62 is secured to the front surface of the flange 60, and is adapted to engage the surface of the brake disc 44 upon pivotation of the brake arm 54. The back end of the brake arm 54 extends through a slot 63 in the back side plate 18, and projects beyond the back side plate.

Referring to FIGURES 2 and 4, a drag brake arm 64 is mounted on the shaft 52 by a collar 66. The drag brake arm 64 is positioned along the shaft 52 adjacent the peripheral edge of the brake disc 44, and on the opposite side of the supply spool shaft 30 from the brake arm 54. The front end of the drag brake arm 64 extends below the shaft 52, and is bent to provide a flange 68 which is adjacent and parallel to the brake disc 44. A brake shoe 70 is secured to the front surface of the flange 68, and is adapted to engage the brake disc 44 upon pivotation of the drag brake arm 64.

As shown in FIGURE 3, a helical spring 72 is secured at one end to the brake arm 54 behind the shaft 52 and adjacent the inner surface of the back side wall 18. As shown in FIGURE 4, a helical spring 74 is secured at one end to the back end of the drag brake arm 64. The springs 72 and 74 extend downwardly from the brake arms 54 and 64 respectively. Separate cords 76 and 78 are secured at one end to the bottom ends of the springs 72 and 74 respectively. The cords 76 and 78 extend downwardly and around separate rollers 80 and 82 respectively, which are mounted in the casing 12 adjacent the base plate 14. The rollers 80 and 82 are supported on shafts 84 and 86 respectively, which extend between and are supported by the side plates 16 and 18. From the rollers 80 and 82, the cords 76 and 78 extend upwardly, and are secured to the bottom ends of the adjustment rods 88 and 90 respectively. Adjustment rods 88 and 90 extend vertically parallel to the side plates 16 and 18, and project through openings in the top plate 20. The top ends 88*a* and 90*a* of the adjustment rods 88 and 90 are threaded. Adjustment nuts 92 and 94 are threaded on the top ends 88*a* and 90*a* of the adjustment rods 88 and 90 respectively, and are seated on the top surface of the top plate 20. Thus, by rotating the adjustment nuts 92 and 94, the adjustment rods 88 and 90 are moved vertically to vary the tension of the springs 72 and 74, and thereby vary the pressure of the brake shoes 62 and 70 against the brake disc 44.

As shown in FIGURE 1, an indicator plate 96 is secured to the adjustment rod 88, and extends horizontally across the space between the end edges of the side plates 16 and 18. A similar indicator plate 98 (see FIGURE 4) is secured to the adjustment rod 90, and extends across the space between the side plates 16 and 18. The indicator plates 96 and 98 move vertically with the adjustment rods 88 and 90 so as to provide an indication of the setting of the tension in the springs 72 and 74. Thus, the indicator plates 96 and 98 permit ease of setting a desired tension in the springs 72 and 74.

A vertical supporting post 100 is secured to the outer surface of the back side plate 18, and extends upwardly beyond the top plate 20. Post 100 is provided with a vertical slot 102 extending from the top end thereof. A control arm 104 extends through the slot 102 in the post 100, and is pivotally supported in the slot 102 by a pivot pin 106. The control arm 104 is pivotally supported at a point adjacent to but spaced from the back end thereof. A linkage rod 108 is hingedly secured at one end to the back end of the control arm 104, and is hingedly connected at its other end to the back end of the brake arm 54. Thus, pivotation of the control arm 104 pivots the brake arm 54 to vary the pressure of the brake shoe 62 against the brake disc 44. The control arm 104 is of a length to extend over the supply spool 32, and a pulley 110 is rotatably supported on the front end of the control arm 104.

As shown in FIGURES 2 and 3, a nozzle block 112 is secured to the inner surface of the front side plate 16 by screws 114. Nozzle block 112 is positioned over the shaft 30, and against the top plate 20. The nozzle block 112 has a projection 116 extending through an opening 118 in the front side plate 16. The nozzle block 112 is provided with a small diameter passage 120 extending from one end of the block to the front surface of the projection 116. The longitudinal axis of the exit end portion of the passage 120 is substantially perpendicular to the surface of the blades 42 of the impulse wheel 38. The inlet end of the passage 120 has a threaded counterbore 122. A tube 124 (see FIGURE 1) is connected to the inlet end of the passage 120. The tube 124 is adapted to be connected to a source of air under pressure (not shown) so as to supply the air under pressure to the passage 120. The passage 120 directs the air as a jet stream against the surfaces of the blades 42 of the impulse wheel 38 to assist rotation of the shaft 30.

The tensioner 10 of the present invention operates as follows:

The filament supply spool 32 is mounted on the shaft 30, and is tightly secured between the conical nut 36 and the hub 40 of the impulse wheel 38 so that it rotates with the shaft 30. The filament 34 passes from the supply spool 32 upwardly and over the pulley 110 on the control arm 104, and then to the winding machine (not shown). A desired tension on the filament 34 is obtained by rotating the nut 92 on the adjustment rod 90 to apply tension to the spring 72. When the spring 72 is under tension, the spring pulls downwardly on the back end of the brake arm 54. This pivots the brake arm 54 to bring the brake shoe 62 into engagement with the brake disc 44, and thereby apply a drag on the brake disc. The drag on the brake disc 44 limits the speed of rotation of the shaft 30 and the supply spool 32. If the spring 72 can be tensioned sufficiently to provide a sufficient drag on the shaft 30 to achieve the desired tension on the filament 34, the tension on the spring 74 connected to the drag brake arm 64 can be completely relieved so that the brake shoe 70 does not apply any pressure on the brake disc 44. However, if additional tension on the filament 34 is required, the spring 74 can be tensioned by means of the nut 94 to pivot the drag brake arm 64 and bring the brake shoe 70 into engagement with the brake disc 44. The source of air under pressure to which the tube 124 is connected is then turned on to provide a jet stream of air through the passage 120, and against the blades 42 of the impulse wheel 38.

During the operation of the winding machine, the filament 34 is pulled from the supply spool 32, and thereby rotates the supply spool and the shaft 30. The drag on the shaft 30 provided by the engagement of either the brake shoe 62 alone or the brake shoe 62 and the brake shoe 70 against the brake disc 44 causes the desired tension on the filament 34. If the tension on the filament 34 is increased beyond the desired set tension, the filament will pull downwardly on the pulley 110 to pivot the control arm 104 in the direction of the arrow 126 in FIGURE 1. Such pivotation of the control arm 104 lifts the back end of the brake arm 54 upwardly to pivot the brake arm and release the force of the brake shoe 62 against the brake disc 44. The release of the force of the brake shoe 62 against the brake disc 44 permits the shaft 30 and the supply spool 32 to rotate more freely. Since the air blast from the passage 120 is continuously impinging on the blades 42 of the impulse wheel 38, the force of the air blast against the blades 42 immediately causes the shaft 30 and the supply spool 32 to rotate faster. The increase in the speed of rotation of the supply spool 32 decreases the tension on the filament 34. As the tension on the filament 34 decreases, the tension in the spring 72 pivots the brake arm 54 and the control arm

104 back to their normal positions so as to reapply the brake shoe 62 against the brake disc 44, and thereby reobtain the desired tension on the filament 34.

Thus, in the operation of the tensioner 10 of the present invention, the air blast which is continuously impinging on the blades 42 of the impulse wheel 38 causes an increase in the speed of rotation of the filament supply spool 32 immediately upon a decrease in the drag on the shaft 30. This, in turn, reduces the tension on the filament 34 so as to maintain the filament under the desired tension. Thus, the tensioner 10 not only substantially eliminates any delay in the reduction of the tension on the filament back to the desired tension setting, but also prevents any further increase in the tension on the filament which would be necessary to overcome the weight of the filament supply spool. Therefore, the tensioner 10 of the present invention controls the tension on the filament with a minimum variation in the tension so as to greatly reduce, if not completely eliminate, the chances of the filament being broken. This permits the winding of very fine filaments at high speeds without causing breakage of the filament.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A filament tensioner comprising a support, a filament supply spool shaft rotatably mounted on said support, brake means for controlling the speed of rotation of said shaft, means controlled by the filament for operating said brake means, an impulse wheel mounted on said shaft, said impulse wheel having a plurality of blades extending radially therefrom, and means for providing a continuous blast of air against said impulse wheel blades said blast of air impinging on said impulse wheel blades in a direction so as to rotate the impulse wheel and filament supply spool shaft in the direction to unwind the filament from the supply spool.

2. A filament tensioner in accordance with claim 1 in which the brake means comprises a brake disc mounted on the shaft, a brake arm pivotally supported between its ends on said support with one end of the brake arm being adjacent the brake disc, and a brake shoe on said one end of the brake arm and engageable with said brake disc, pivotation of said brake arm varying the force applied to said brake disc by said brake shoe.

3. A filament tensioner in accordance with claim 2 including spring means secured to the brake arm and adapted to pivot said brake arm to apply a desired force on the brake disc by the brake shoe.

4. A filament tensioner in accordance with claim 3 including means for varying the force applied to the brake arm by the spring means.

5. A filament tensioner in accordance with claim 4 in which the means for controlling the brake means comprises a control arm pivotally supported between its ends on the support, linkage means connecting one end of the control arm to the other end of the brake arm, and means on the other end of the control arm over which the filament is adapted to pass so that variations in the tension on the filament causes pivotation of the control arm.

6. A film tensioner in accordance with claim 5 including a drag brake arm pivotally supported between its ends on said support with one end of the drag brake arm being adjacent the brake disc, a brake shoe on said one end of the drag brake arm and engageable with the brake disc, spring means connected to said drag brake arm and adapted to pivot said drag brake arm to apply a desired force on said brake disc by said brake shoe, and means for varying the force on said drag brake arm by said spring means.

7. A filament tensioner in accordance with claim 6 in which the means for providing a continuous air blast includes a nozzle mounted on the support, said nozzle being positioned to direct a flow of air passing therethrough against the blades of the impulse wheel.

8. A filament tensioner comprising a casing having a base plate, a pair of side plates secured to and extending upwardly from said base plate, and a top plate extending between and secured to the top edges of the side plates, a horizontal shaft rotatably supported on said side plates and projecting beyond one of said side plates, said shaft being adapted to support a filament supply spool, an impulse wheel mounted on said shaft adjacent to the outer surface of said one side plate, said impulse wheel having a plurality of blades extending radially therefrom, a nozzle mounted on said one side plate, said nozzle being positioned to direct a flow of air passing therethrough against the blades of said impulse wheel with the flow of air impinging on the blades in a direction so as to rotate the impulse wheel and shaft in a direction to unwind the filament from the supply spool, a brake disc mounted on said shaft between said side plates, brake means supported in said casing and adapted to engage said brake disc to control the speed of rotation of said shaft, and means controlled by the filament for operating said brake means.

9. A filament tensioner in accordance with claim 8 in which said brake means comprises a brake arm pivotally supported between its ends within the casing, one end of said brake arm being adjacent the brake disc and the other end of the brake arm extending through and projecting beyond the other side plate of the casing, a brake shoe on the one end of the said brake arm and engagable with the brake disc, pivotation of said brake arm varying the force applied to the brake disc by the brake shoe.

10. A filament tensioner in accordance with claim 9 including spring means secured to the brake arm and adapted to pivot said brake arm to apply a desired force on the brake disc by the brake shoe.

11. A filament tensioner in accordance with claim 10 including means for varying the force applied to the brake arm by the spring means.

12. A filament tensioner in accordance with claim 11 including a vertical post secured to the other side plate of the casing and projecting above the top plate, and the means for operating the brake comprises a control arm pivotally supported between its ends on said post, linkage means connecting one end of the control arm to the other end of the brake arm, and means on the other end of the control arm over which the filament is adapted to pass so that variations in the tension on the filament causes pivotation of the control arm.

13. A filament tensioner in accordance with claim 12 including a drag brake arm pivotally supported between its ends in the casing with one end of the drag brake arm being adjacent the brake disc, a brake shoe on said one end of the drag brake arm and engagable with the brake disc, spring means connected to said drag brake arm and adapted to pivot said drag brake arm to apply a desired force on said brake disc by said brake shoe, and means for varying the force on said drag brake arm by said spring means.

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