United States Patent

Gerest

[15] **3,707,269**

[45] **Dec. 26, 1972**

[54] **FILAMENT TENSIONING APPARATUS**

[72] Inventor: **Marcel A. M. Gerest**, Paris, France

[73] Assignee: **Societe A Responsabilite Limitee Dite Altic**, Paris, France

[22] Filed: **May 27, 1970**

[21] Appl. No.: **41,044**

[30] **Foreign Application Priority Data**

May 28, 1969 France.....6917286

[52] **U.S. Cl.**.....**242/155 R**

[51] **Int. Cl.**.....**B65h 59/16**

[58] **Field of Search**...242/155 R, 155 M, 156, 156.2, 242/45, 147, 149, 153, 154

[56] **References Cited**

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Primary Examiner—Stanley N. Gilreath
Attorney—Fishman & Van Kirk

[57] **ABSTRACT**

An automatic wire tensioning device for regulating the tension in a filament on a rotatable pulley during reeling and unreeling operations. The braking force on the pulley is controlled by a friction brake which is operated by a force balancing lever actuated by a braking spring and a wire tension spring. The braking spring has an adjustable loading and the wire tension spring senses the actual tension on a wire wound around and frictionally engaged with the pulley in an interdependent manner.

6 Claims, 2 Drawing Figures

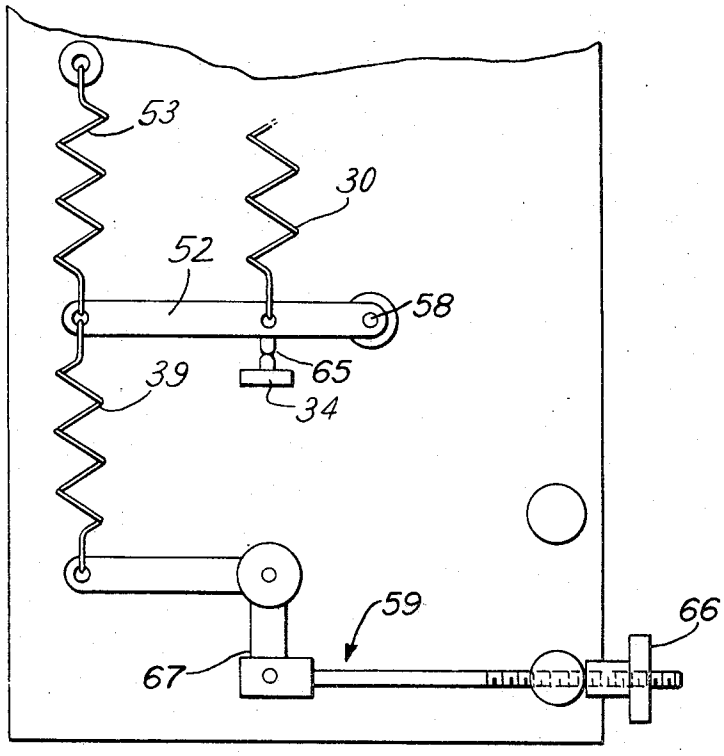


Fig. 1.

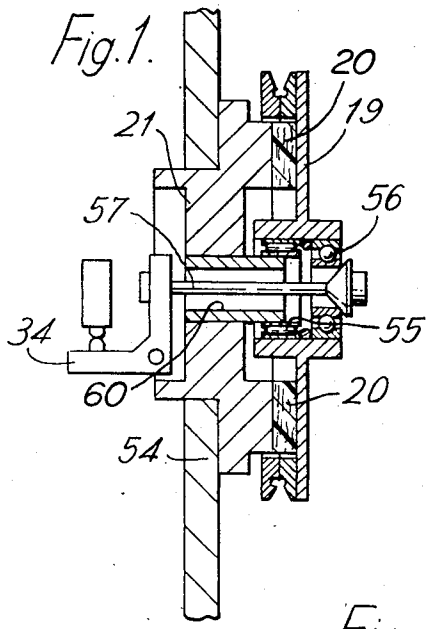
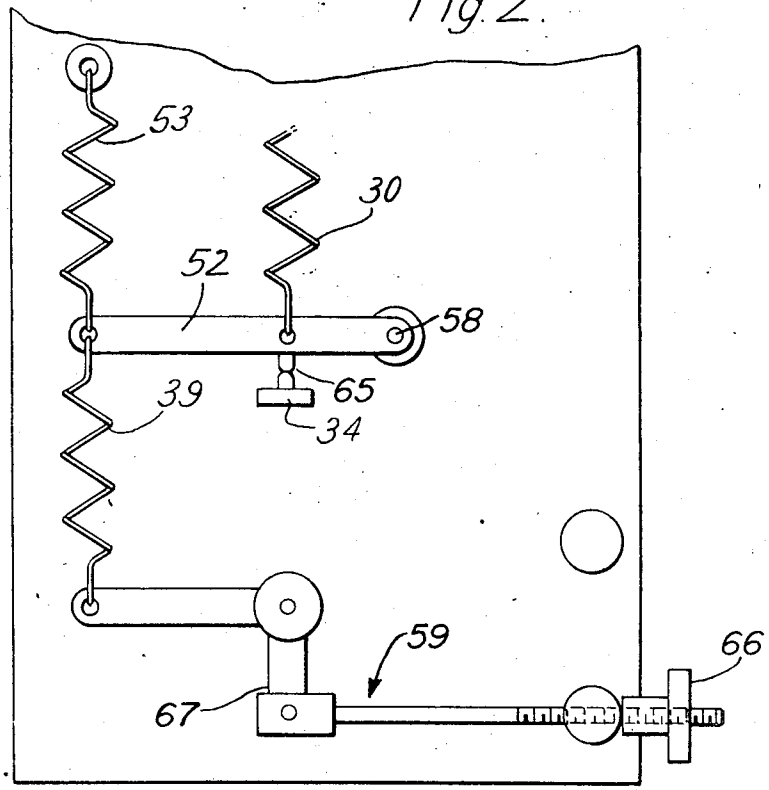


Fig. 2.



FILAMENT TENSIONING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an automatic device for regulating wire or thread tension during reeling and unreeling in winding, spooling, reeling or unreeling machines, twisting frames and generally in all appliances wherein it is necessary to ensure the constant tension of a predetermined value on a thread or wire while passing through said device.

2. Description of the Prior Art

The invention concerns, in particular, braking arrangements for automatic wire tension regulators which operate during winding and unwinding and comprise a wire-tensioning device and a device measuring the resulting tension, the two mechanisms inter-reacting continuously and progressively in such manner as to maintain the tension of the wire at a prescribed value. Such devices are for example described in the French Pat. No. 1,241,232 and its First Addition, No. 76,577. These devices comprise, in particular, a drum or pulley to which a wire to be handled is frictionally connected and to which a resisting torque is applied by two plates or discs, the one rotating and the other fixed. The plates are made of suitable materials and forced against each other by a load, the value of which depends on the action of a dynamometric device continuously measuring the tension at which the wire is delivered from the appliance.

One feature of the prior art devices is that there is no reciprocal reaction between the resisting torque and the signal controlling the torque value, the latter being controlled solely by the indications of the dynamometric device.

Although the prior art devices briefly described above provided satisfactory results for a number of applications, as the speed of passage of the wire and the wire tension increase, both operating characteristics causing an increase in the amount of heat generated, the performance of the prior art devices decreases significantly to an undesirable level. In addition, the prior art devices have a relatively slow response thereby producing undesirable variations in wire tension.

It is accordingly an object of the present invention to remedy the disadvantages of the already known forms of prior art wire tensioning devices.

SUMMARY OF THE INVENTION

The present invention relates to an automatic device for regulating the tension of one or more wires to allow reeling or unreeling to proceed under constant tension. The invention is characterized by a braking device with a fixed plate or disc having an extensive heat-dissipating surface, and a rotating pulley on which one or more wires to be tensioned are frictionally engaged. The pulley has a braking surface in contact with one of the surfaces of the fixed plate, and the braking surface of the rotating pulley is applied against the fixed plate with a pressure depending on the required tension of such wire or wires.

In accordance with a particular feature of the present invention the pressure applied by the rotating pulley to the fixed plate is furnished by a lever mechanism to which a first or braking force is applied. The first force is generated by means including an adjustable braking spring. A second force is also applied to the lever mechanism. The second force is generated by a dynamometric system comprising a second spring and said second force acts in the opposite direction to said first force. The second force varies with the tension of the wire to be handled. Variations in the magnitude of the second force are transmitted to the braking system in such a manner that the braking system is actuated to reset the wire tension to its required initial value. Thus, if wire tension increases the second force applied by said second spring also increases in the opposite direction to the first braking force and the braking torque will accordingly increase thereby reestablishing the initial balance between wire tension and braking torque. To decrease inertia, and thereby decrease the response time of the system and provide a suitable dynamic characteristic, a third or compensating spring is attached to the lever mechanism for the purpose of balancing the weight of the components of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous objects and advantages of the present invention will be more clearly apparent from the following description of a preferred embodiment of the invention illustrated by the accompanying drawing wherein like reference numbers refer to like elements throughout the several figures.

FIG. 1 shows a sectional view of the braking device of the automatic regulating system for tensioning a wire in accordance with the present invention;

FIG. 2 shows a portion of a wire tension sensing means and a balancing mechanism for use with the tensioning device of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 of the accompanying drawing, the braking arrangement according to the invention comprises a fixed plate or disc **21** which is in heat-transmitting contact with a frame or bedplate **54**. The bedplate **54** has a surface area of considerable size and sufficient volume to act as a support for the mechanical assembly and as a heat dissipator as will be described in detail below. The fixed plate **21** is in contact with a brake lining **20** under an adjustable pressure. The lining **20** is itself carried on a rotating pulley **19** on which one or more wires are wound in frictional engagement therewith, in order to maintain the wires under the required tension. A resisting torque is obtained on the pulley by pressing the assembly of the rotating pulley **19** and the brake lining **20** against the fixed plate **21**.

This arrangement of the elements in the braking system having the shape of plates or discs is particularly advantageous since it prevents any reaction of the braked element on the elements controlling the braking power.

The brake plate or block **21**, which is made of pearlite cast iron or other suitable material, is suitably machined to make it capable of heat transmission to the frame or bedplate **54**, as described above. The frame or bedplate **54** serves as a radiator and thus ensures good dissipation of the heat produced by braking. The brake lining or pad **20** which may be of any suitable material, such as leather, felt or plastic, is attached to the pulley **19** by rivets, cement or snaprings or in any

other suitable manner. The pulley **19** is mounted to a spindle housed in the brake block by means of a needle bearing **55**. The pulley **19** and brake lining **20** are pressed against the brake block by means of a ball bearing **56** preferably having a bevelled race, a connecting rod **57** and a bellcrank lever **34**. The connecting rod **57** passes through a tubular axle **60** about which the pulley **19** rotates on bearing **55**. The force tensioning the wire or wires is applied to the horizontal arm of the bellcrank lever **34**. This force is generated by the remainder of the balance between the force generated by a braking spring and the force generated by a dynamometric spring. As seen more clearly in FIG. **2**, this force is the resultant of the opposed forces applied to a single pivotal lever, on the one hand by a braking spring **39**, and on the other hand by the dynamometer spring **30** as described in the French Pat. No. 1,241,232 and its First Addition No 76,577.

With reference still to FIG. **2** of the accompanying drawing, it will be seen that the adjustable brake spring **39** operated by a tensioning device indicated generally at **59** exerts a desired force on the bellcrank lever **34** through the pivotal balancing lever **52**, to which is also attached dynamometric spring **30**, providing by means of adequate selection of points of attachment on the lever **52** a suitable balancing of the forces in action, and allowing suitable dimensioning of the springs. As described in the aforementioned French patents, a force proportional to the wire tension is applied to the spring **30** from a thread tension sensor **60** connected to the upper end of spring **30**. A typical wire tension sensor of the type described in the aforementioned French patents, the disclosures of which are incorporated herein by reference, comprises a "jack" mechanism having a pair of angularly related arms; the mechanism being pivotable about the junction of the arms. Such a mechanism is indicated by reference numerals 27, 28 and 29 of French Pat. No. 1,241,232. The point of attachment of the spring **30** to one of the arms is adjustable, in the French patent by means of mechanism **31**, and the end of the opposite arm is provided with an idler pulley. The wire being handled is passed over the idler pulley and the desired tension is set by adjusting the point of connection between spring **30** and the opposite arm of the pivotal "jack" assembly.

In operation, lever **52** pivots about axis or pivot point **58** and bears against the horizontal arm of bell crank lever **34** by means of steel pins or projections **65**. The braking force exerted by spring **39** depends upon the spring tension which can be regulated by means of a knob **66** via a toggle lever **67**. After the apparatus has been put into service, a second force opposite to the braking force is applied to lever **52** by means of spring **30**. The magnitude of this second force is dependent upon the value selected for the wire tension; i.e., the second force is selected from graduations provided along arm **28** of French Pat. No. 1,241,232. If the force applied by spring **39** has been adjusted correctly; the braking pulley **19** turns during reeling of the wire off a storage drum and the present tension or second force is automatically maintained. According to a particular feature of the invention, a compensating spring **53** is further provided, attached to the lever **52**, which allows the regulating range to be increased by balancing the gravitational loads or weights of the several elements associated with the spring **39**, and furnishing suitable dynamic characteristics of the resisting torque through suitable choice and location of the said spring.

The invention can be applied to any machine for unreeling twisting, preparing electric windings and, in general, to all appliances in which it is necessary to maintain a constant tension on the thread or wire used, whether a textile yarn, or an electric wire, or a plurality of such threads or wires, as for instance, a combination of threads or wires of different kinds.

What is claimed is:

1. Apparatus for automatically regulating the tension of a filament being wound on a rotatable reel comprising:

pulley means, said pulley means including a pulley having a braking surface on one side thereof, the filament being wound passing about and frictionally engaging said pulley;

frame means;

means mounting said pulley means from said frame means, said mounting means permitting axial and rotational movement of said pulley means;

brake means affixed to said frame means, said brake means including a non-rotatable braking element positioned in operative relationship with the braking surface on said pulley, said braking element being in heat dissipating contact with said frame means;

adjustable means for generating a braking force;

means resiliently coupling said braking force generating means to said mounting means for causing axial motion of said pulley with respect to said frame means whereby a preselected degree of frictional contact between said braking element and pulley braking surface may be established, said resilient coupling means including:

force balancing lever means, said lever means including an elongated lever having a pivot point and a first point displaced along said lever between said pivot point and a first end of said lever, said first point being mechanically coupled to said mounting means; and

spring means connecting a second point along said lever to said adjustable braking force generating means, said spring means including a first resilient element and said second point being on the same side of the pivot about which said lever means pivots as said first point whereby said first resilient element will urge said lever first point into operative engagement with said mounting means; and

means for applying an adjustable preselected tensioning force to said coupling means in opposition to said braking force whereby the braking force and selected tensioning force will be balanced.

2. The apparatus of claim **1** further comprising:

means for generating and applying a compensating force to said coupling means, said compensating force balancing gravitional loads and damping vibrations.

3. The apparatus of claim **2** wherein said compensating force generating means comprises:

resilient means, said resilient means acting in opposition to said spring means.

4. The apparatus of claim **1** wherein said mounting means comprises:

bell crank means mounted for rotation on said frame means, a first arm of said bell crank means being mechanically coupled to said force balancing lever means;

tubular axle means extending from said frame means;

means mounting said pulley means for rotation about and along said axle means;

connecting rod means mechanically coupled to the second arm of said bell crank means and extending coaxially of said axle means, said connecting rod means being movable axially of said pulley means; and

means mechanically coupling said connecting rod means to said pulley means whereby rotation of said bell crank means will cause axial movement of said pulley means thereby varying the operative relationship between said pulley braking surface and said braking element.

5. The apparatus of claim 3 wherein said mounting means comprises:

bell crank means mounted for rotation on said frame means, a first arm of said bell crank means being

mechanically coupled to said force balancing lever means;

tubular axle means extending from said frame means;

means mounting said pulley means for rotation about and along said axle means;

connecting rod means mechanically coupled to the second arm of said bell crank means and extending coaxially of said axle means, said connecting rod means being movable axially of said pulley means; and

means mechanically coupling said connecting rod means to said pulley means whereby rotation of said bell crank means will cause axial movement of said pulley means thereby varying the operative relationship between said pulley braking surface and said braking element.

6. The apparatus of claim 5 wherein said pulley means further comprises:

brake lining means mounted on said pulley braking surface.

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