Jan. 10, 1939. J. P. MADDEN 2,143,200

TENSION CONTROLLING DEVICE

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Fig. 1.

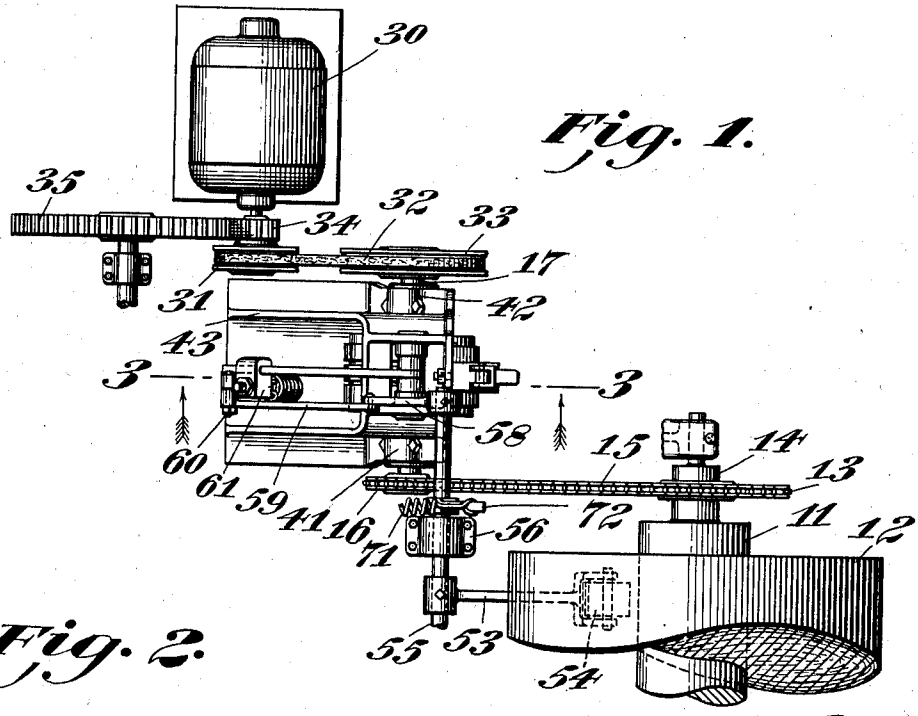

Fig. 2.

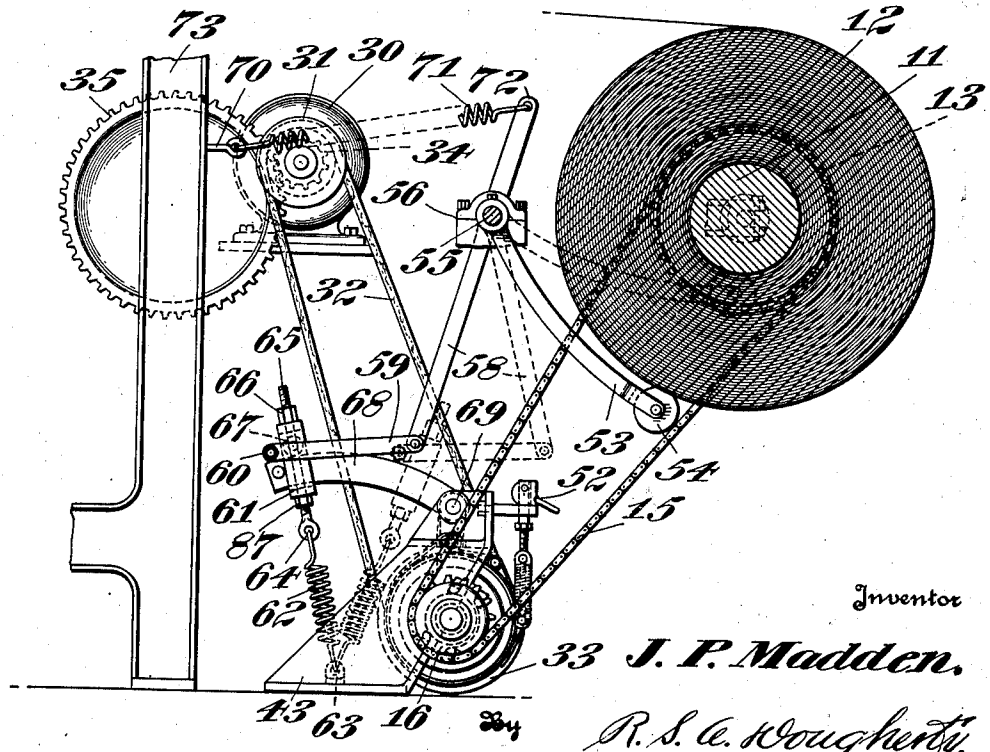

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Fig. 3.

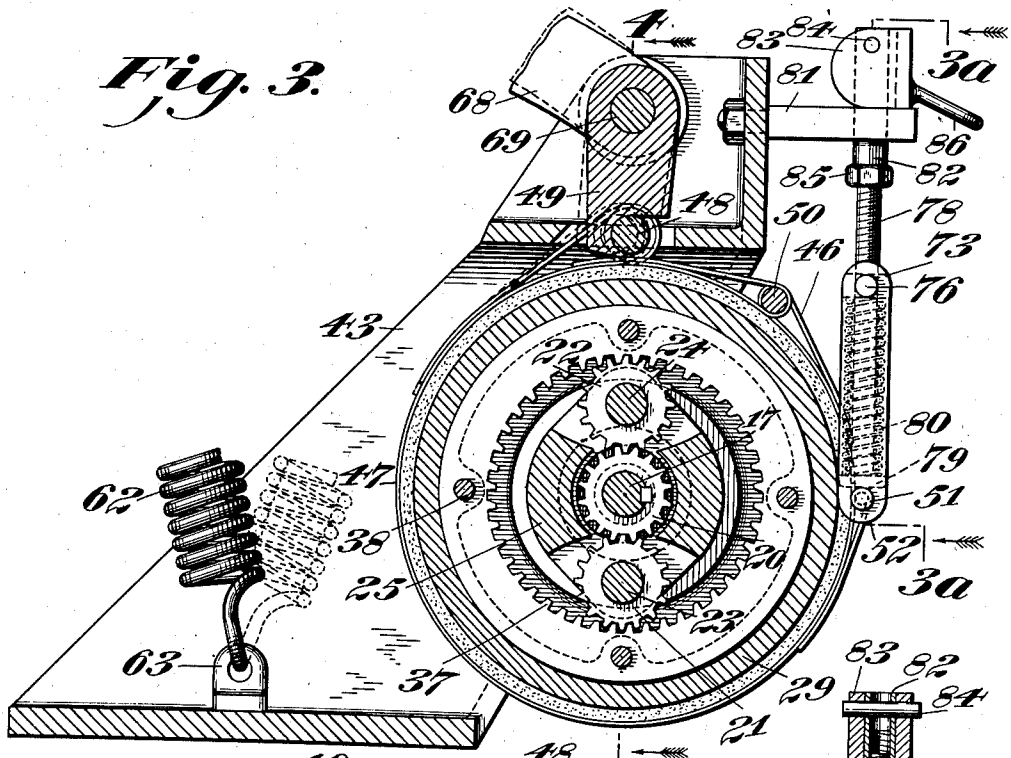

Fig. 4.

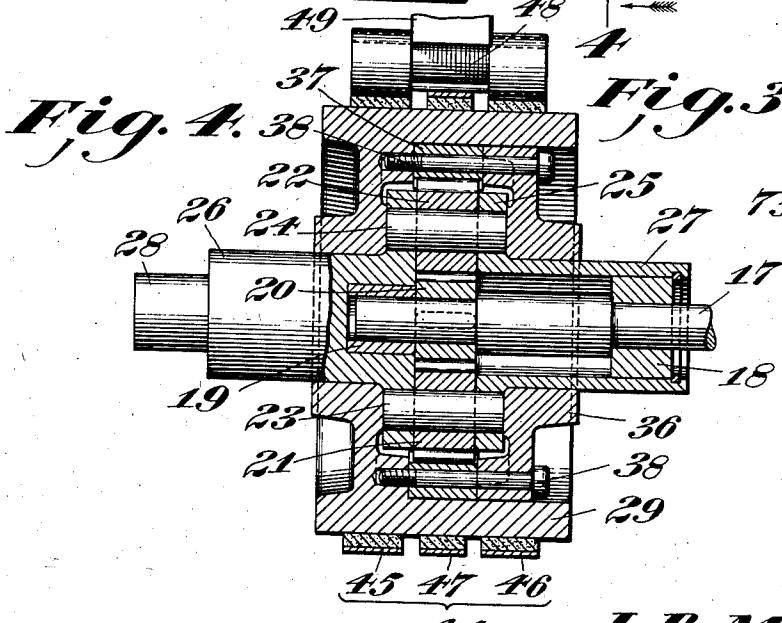

Fig. 3a.

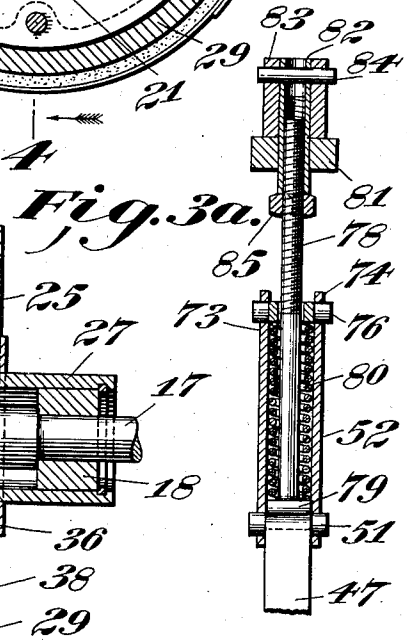

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Fig. 5.

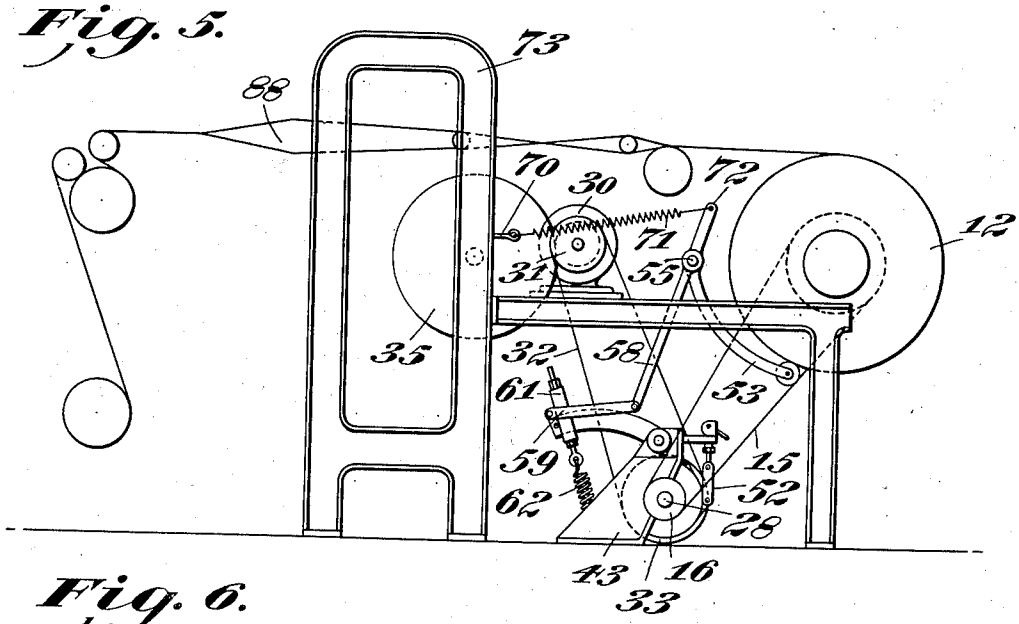


Fig. 6.

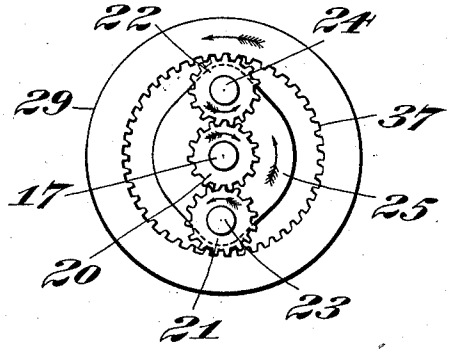


Fig. 8.

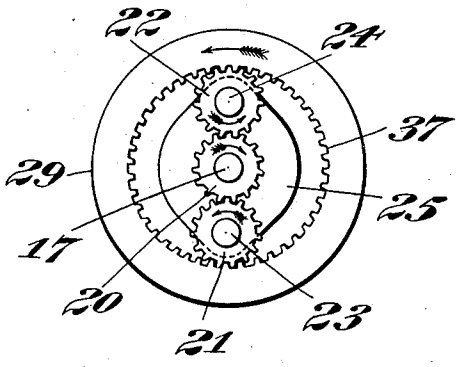
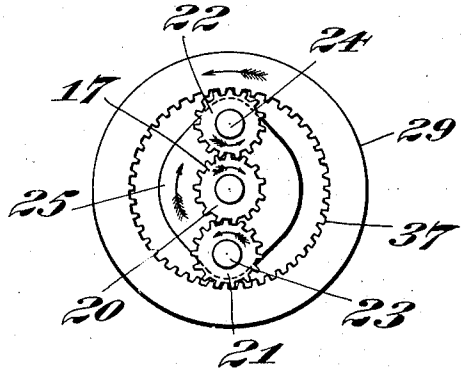


Fig. 7.



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Patented Jan. 10, 1939 2,143,200

UNITED STATES PATENT OFFICE

2,143,200

TENSION CONTROLLING DEVICE

James P. Madden, Bethlehem, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application February 14, 1936, Serial No. 63,914

3 Claims. (Cl. 139—107)

This invention relates to improvements in tension controlling devices, and particularly to devices for use in fields where the movement of the material under tension is intermittent and changing both as to rate of travel and direction of travel.

The invention is particularly adaptable to devices for causing tension to be applied to threads or other materials as they are unwound from a drum or beam, such as are in common use in the textile industry. In certain of these devices tension on the threads is applied by a friction means which engages a surface of the drum or beam to resist its rotation. Another well known means employed for this purpose is a weight applied to the periphery of a part of the beam and which tends to rotate the latter at all times in a certain direction. This latter means is commonly used with machines which operate to unwind the material comparatively slowly, and in which the beam rotates intermittently and in reverse direction; a good example of such a machine is a cloth weaving loom. These known types of devices aforementioned are not very dependable as in all such cases the tension on the material varies as the parts of the devices change from a static condition to that of relative movement, or vice versa, in fact in certain cases, the tension of the material is considerably increased before static friction and/or inertia of the parts is overcome.

It is one of the objects of my invention to provide a tensioning let-off mechanism which maintains a substantially constant tension in the material being unwound from a drum or the like or material being unwound or wound on the beam of a loom or the like.

It is another object of my invention to provide a tensioning device for the beam of a loom or the like which includes a controlling device of the frictional type that has a substantially constant coefficient of friction during the operation of the loom and at the same time applies a torque to the beam in the manner of the well known weight used as aforesaid.

It is a further object of this invention to provide independent means for removing the tension from the material and restoring it thereto without necessarily interrupting the movement of the material.

It is still a further object to provide safety means whereby possible damage to the friction means is obviated.

Broadly stated, my invention comprises a continuously operating power means adapted to transmit a predetermined torque to a loom let-off means and the like, whereby the loom let-off is urged to rotate in a direction opposite to that in which it rotates when the material is unwinding therefrom.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawings, in which

Fig. 1 is a plan view of my invention operatively connected to the end of the warp-beam of a loom;

Fig. 2 is an end elevation of the structure shown in Fig. 1;

Fig. 3 is an enlarged sectional view taken along the line 3—3 of Fig. 1;

Fig. 3*a* is a view in vertical section of a portion of my device along the line 3*a*—3*a* of Fig. 3;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a diagrammatic end elevation showing portions of the loom structure with my device operatively connected thereto;

Figs. 6, 7 and 8 are diagrammatic representations of a portion of the device illustrating various operating conditions.

The warp-beam 11 bearing the warp 12 being unwound is connected to my device through sprocket 13 keyed to the shaft 14 of warp-beam 11, chain 15 and sprocket 16. Power is supplied to the device by loom motor 30 through pulleys 31 and 33 and belt 32. The motor also operates the loom through gears 34 and 35. It will, of course, be obvious that, where desired, a separate motor may be used for operating my device. Further, my device may be so placed as to connect directly with the shaft of the warp-beam instead of through chain and sprockets.

Pulley 33 is keyed to shaft 17 which is journaled in bearings 18 and 19 (Fig. 4). Also keyed to shaft 17 is pinion 20 which meshes with pinions 21 and 22 rotatably mounted on shafts 23 and 24 respectively, held in spider member 25, which is integral with journal portions 26 and 27 and shaft 28. Drum member 29 revolves on journal portion 26 at one end and is supported at the other end by end piece 36 which revolves on journal portion 27. Between drum 29 and end piece 36 is ring gear 37 which is clamped in position by bolts 38. Ring gear 37 also meshes with pinions 21 and 22. Journal portions 26 and 27 are further supported in bearings 41 and 42 in frame 43.

Wrappingly engaging drum member 29 is the friction band system 44 comprising the two work bands 45 and 46 and control band 47. The work

bands are attached at one end to pin 48 held by lever arm 49 and at the other end to the extremities of pin 50. To the middle of pin 50 is attached one end of control band 47 which at its other end is attached to pin 51 of the throw-off and safety device 52.

Follower arm 53 carrying revolvable follower roll 54 is keyed to shaft 55 mounted in suitable bearings 56. Arm 58 is also keyed to shaft 55 at one end, while at its other end link 59 is pivotally connected. The other end of link 59 is pivotally connected to block 61 by bolt 60. Secured to loom-frame 73 in suitable position by means of eye-bolt 70 is tension spring 71 which at its other end is connected to lever 72 keyed to shaft 55. This spring is adapted to keep follower roll 54 pressing against the roll of material being unwound.

Tension spring 62 is secured at its lower end to the floor of frame 43 by means of eye 63 and at its upper end to the eye 64 of threaded bolt 65 which passes through block 61 and is secured by nuts 66 and 67. Revolvably mounted in block 61 is roller 67 to facilitate movement of block 61 along arcuate arm 68. The arcuate arm 68 is keyed to shaft 69 mounted in frame 43. Also keyed to shaft 69 is lever arm 49 adapted to engage the center portion of pin 48. This member serves to control the frictional torque exerted by band system 44.

The throw-off and safety device 52 comprises the two side pieces 73 and 74 joined at the bottom by pin 51 to which is connected the end of control band 47, and joined at the top by member 76. Member 76 has an opening to permit passage therethrough of bolt 78. Mounted on bolt 78 and held under compression by bolt head 79 and member 76 is spring 80. The upper end of bolt 78 passes through bracket 81 secured to frame 43 and threadedly engages tubular member 82 mounted in the yoke of cam member 83 by pin 84, this tubular member serving as an adjustment to tighten bands 45, 46 and 47 as they become worn. Nut 85 acts as a lock nut to hold a given adjustment. By lifting the handle 86 of cam member 83 the bolt 78 and side pieces 73 and 74 are lowered and tension is thereby removed from the material to permit "ripping out" in the woven material. In case of excessive drag on the control end of the band system 44 which would occur if the warp-beam were forcibly turned in a backward direction, the spring 80 is adapted to yield under the increased compression, thus lowering side pieces 73 and 74 slightly, diminishing the drag effect and avoiding damage.

It is important that the safety device be applied to the end of the band system which is devoid of any substantial force imparted to the band system by virtue of its frictional contact with the rotating drum during the operation of the machine. The end of the band system anchored to the pin 48 is subject to a comparatively large force due to the drag of the bands on the drum, as compared with the force at the end of the band system anchored on pin 51. If the safety device was positioned to release the end associated with the pin 48 then it would require a considerable force to operate the cam member 83 against the pull of the drum on the band system at that end, whereas, such pull does not oppose the operation of the safety device when positioned at the other end of the band system, as in my arrangement, wherein the only resistance to the operation of the safety device is the force imposed by the comparatively light spring 80.

In connection with a silk loom or similar mechanism the operation of my invention is as follows:

Referring to Figs. 2 and 3 pulleys 31 and 33 and belt 32 cause shaft 17 to revolve in a clockwise direction. Pinion 20 keyed to shaft 17 and meshing with pinions 21 and 22 tends to cause spider member 25 and shaft 26 integral therewith also to revolve in a clockwise direction. Shaft 26, through sprockets 13 and 16 and chain 15 causes shaft 14 also to tend to revolve in the same direction. If there is slack in the material leaving the warp-beam the latter will revolve to take up this slack. When the material has come under a predetermined tension depending upon the frictional resistance imparted to the drum 29 by the friction bands as hereinafter described, the warp-beam no longer revolves and the spider 25 is brought to rest. However, the pinion 20 continues its rotation and drives the pinions 21 and 22 on their own axes thereby rotating ring gear 37 causing it and drum member 29 to which it is attached to revolve in a counter-clockwise direction. The tension of spring 62 through arms 68 and 49 is applied to the ends of the bands surrounding drum 29 so that the frictional resistance which must be overcome by drum 29 in revolving is proportional to the spring tension which can be adjusted to any desired degree by nuts 66 and 67 and bolt 65. As the size of the roll of material decreases the follower arm 53 swings upward swinging with it arm 58, both arms being keyed to the same shaft 55. Arm 58 thus moves gradually to the position shown in dotted lines in Fig. 2. Drawn by link 59 block 61 moves inwardly along arcuate arm 68, moving with it spring 62, until it reaches the position also shown in dotted lines in Fig. 2. As spring 62 moves inwardly the force exerted by it on lever arm 49 gradually decreases, which, through the interaction of the parts already described, reduces the resistance to be overcome by beam 11 in its rotation. Thus by the proper proportioning of parts, it is obvious that substantial constancy of tension on the material may be attained during changes of roll diameter, and also that tension is constantly being applied to the threads in direct relation to the amount the friction bands resist the rotation of the drum 29. In other words, during the normal operation of the machine the power of the pinion 20 is distributed to oppose the forward movement of the material and to overcome the friction of the bands as they are applied to the drum 29. However, the direction of travel of the material reverses in the operation of a loom. At certain times during a cycle the material may actually stop moving, or it may have a more complicated movement forward, stop, backward, then stop, but with a net resultant movement forward. As will be seen by reference to Figs. 6, 7 and 8 my device is adapted to meet and overcome the difficulties presented by any such irregular movement. As the shed 88 opens to permit passage therethrough of the shuttle the material is drawn forward. At this moment the spider 25 rotates in the same direction within the ring gear 37 as shown by the arrow in Fig. 6. As the shed reaches its widest point of opening there is a momentary pause of travel of the material, and the spider is then stationary as shown in Fig. 7. As the shed closes there would be a relaxation of the tension on the material, but this is prevented by a clockwise movement of the warp-beam 11 caused by the spider 25 rotating in the direction shown in Fig. 8. In this manner the material is

constantly held in tension under all conditions regardless of the movements imparted to the material.

In certain classes of applications the stretch of the threads and the inertia of the parts are such that the apparatus will not operate to reverse the direction of rotation of the warp-beam in the small interval of time during which the shed is closing and reopening, nor is it necessary that it should do so. During the long interval when the warp-beam is at rest during the passage of the shuttle the warp tension will be adjusted to a standard value, which is not the case with an ordinary loom drag, because of the static friction of the latter.

It is immaterial what speed is imparted to drum **29** by motor **30**, so long as the speed is sufficient so that during all normal movement of the warp-beam continuous slippage in one direction shall take place between drum member **29** and friction band system **44**.

With a device embodying my invention a continuous torque can be applied to a member for storing materials so as to resist the unwinding of the material therefrom and also function to cause the winding up of the materials thereon. The torque transmitted as aforesaid may be varied from practically zero to that which is substantially the equivalent of the power put into the device and is directly proportionate to the amount of power which is expended to overcome the resistance caused by the friction element embodied in my device. For instance, if the power input is insufficient to overcome this resistance then practically the full power will be utilized as torque to create tension on the unwinding materials; on the other hand, when this resistance is removed then no such torque is transmitted. However, I have discovered that in order to maintain a constant tension on the work in any practical operation, the resistance caused by the friction element should in no case be sufficient to prevent continuous slippage between it and the drum, with which it engages, and this is one of the essential features of my invention. Otherwise, if the friction element grips the drum sufficiently tight to prevent its rotation during the normal operation of the machine a static friction condition would exist between the engaging surfaces and create undue tension in the work when the opposed forces are such as to overcome the static friction and cause the drum to rotate.

From the foregoing description it will be seen that I have provided a tensioning device which continuously operates to maintain a tension in the material being unwound from a drum or the like, which tension can be regulated or cut out entirely without stoppage to the unwinding operation, and which operates automatically to take up any slack which may occur in the material due to some particular operation of the machine to which the material is being fed at the time of the unwinding operation.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a tension control a warp-beam, a drum member, frictional means opposing the rotation of said drum member, power supplying means, and means operatively connecting said power supplying means with said drum member and with said warp-beam, to proportion in definite ratio the torque of said power supplying means between said drum member and said warp-beam while causing, during the operation of said control, a continuous slippage between said drum member and said friction means.

2. In a tension control, a warp-beam, a drum member, flexible frictional means wrappingly engaging, and opposing the rotation of, said drum member, power supplying means, and means operatively connecting said power supplying means with said drum member and with said warp-beam, to proportion in definite ratio the torque of said power supplying means between said drum member and said warp-beam while causing, during the operation of said control, a continuous slippage between said drum member and said friction means.

3. In a device of the character described, a rotating drum, a friction band engaging the drum to oppose its rotation, a storage member containing material operatively connected to said drum, adjusting means attached at one end of the band applying a force thereto in a direction opposite to the direction of rotation of the drum, means for changing the amount of material contained on the storage member, means to vary the force applied by the adjusting means in accordance with the change in the amount of material on the storage member, a resilient member maintaining a force at the other end of said band, which is small compared to the first mentioned force, and a quick release operable by a single movement to render said resilient member ineffective.

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