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LET-OFF APPARATUS

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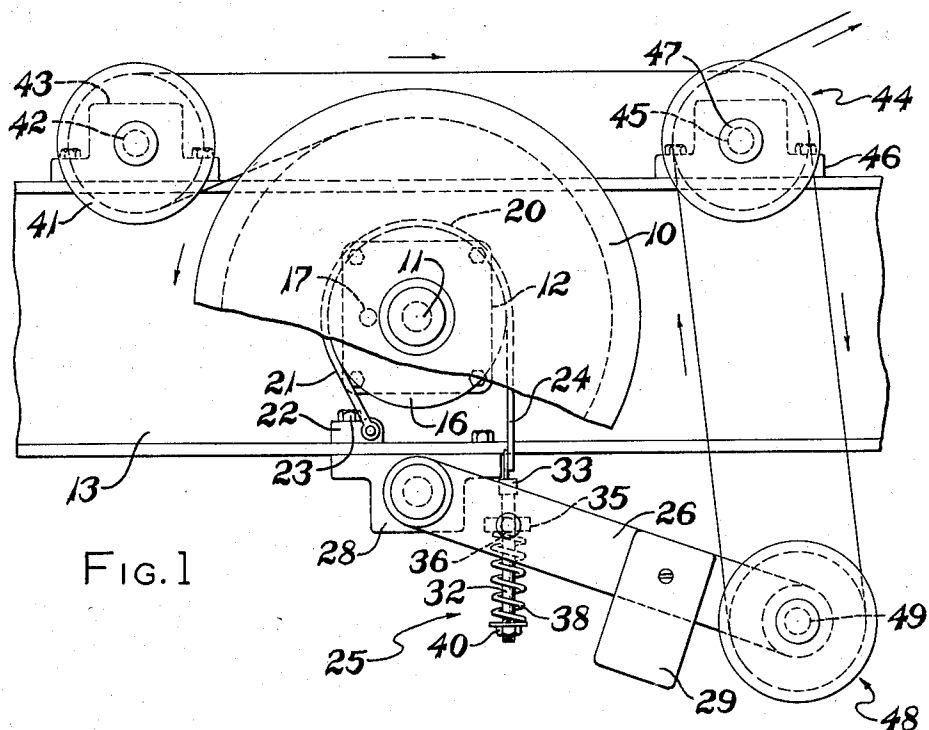


FIG. 1

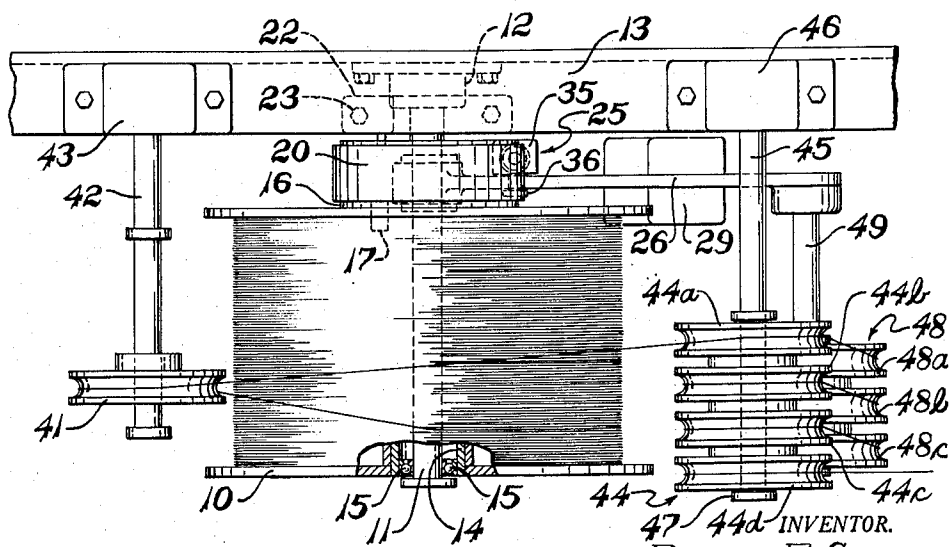


FIG. 2

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1

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LET-OFF APPARATUS

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1 Claim. (Cl. 242—156.2)

This invention relates to let-off apparatus for regulating tension in flexible filamentary material such as wire, textile cords, and the like. It is especially suitable for regulating tension for filamentary material used in the manufacture of hose and other rubber articles in which a great number of individual wires or cords are integrated into structural components of the article.

The apparatus of this invention provides for sensitive tension regulation over a wide range of feeding speeds. It continuously senses the tension in material paying from a supply spool or roll and reacts promptly to retard rotation of the supply spool from which the material is paid whenever tension in the material is reduced below a predetermined level. The apparatus also provides for relief of the retarding forces when the tension in the material is at proper operating conditions. It further includes spring mechanism arranged to prevent shock forces resulting from sudden changes in tension in the wire from being transmitted to the material, thereby avoiding possible breakage of the material. The apparatus is particularly compact and thus lends itself advantageously for use with machinery to which a multitude (e.g. one hundred or more) of individual wires or cords are separately guided for processing.

The invention will be further described with reference to the accompanying drawing which illustrates an apparatus of preferred form made in accordance with and embodying this invention. In the drawing:

Fig. 1 is a side elevation of the apparatus with portions of a spool thereon broken away; and

Fig. 2 is a top plan view of the apparatus of Fig. 1.

In the preferred apparatus a supply spool 10 of wire is mounted for rotation on a spindle 11 which projects laterally from a base 12 secured to a frame 13. The hub of the spool fits slidably upon a tube 14 (Fig. 2) which is supported by a series of bearings 15 on the spindle 11. The inner end of the tube is engaged with a brake drum 16 which is rotatable on the spindle 11 with the tube. The hub of the spool fits snugly around the tube and abuts the adjacent radial face of the brake drum and is engaged with the brake drum by a keying stud 17 projecting from the drum to preclude relative rotation between the spool and the drum. Normally the weight of the spool is sufficient to maintain it properly positioned on the tube but if desired a suitable locking device (not shown) may be secured to the outer end of the tube 14 to prevent axial displacement of the spool.

The rotation of the brake drum 16 and the spool 10 is retarded by a friction brake band 20 of flexible material which engages the periphery of the brake drum 16. One end 21 of the brake band 20 is formed into a loop and is engaged with a flanged lug 22 secured to the frame by a bolt 23. The opposite end 24 of the brake band is resiliently connected by a spring mechanism 25 to a lever 26 which is pivotally mounted on a pintle 28 connected to the frame. The lever 26, as shown in Fig. 1, is mounted for swinging movement in a plane perpendicularly to the spindle 11. The lever 26 normally tends

2

to swing downwardly from the spindle 11 under the influence of a weight 29 which is located on a portion of the lever remote from the pintle and beyond the spring mechanism 25. The weight may be adjustably positioned on the lever to vary the load exerted by the lever on the wire.

The spring mechanism 25 includes a long stud 32 having a head 33 secured to the end 24 of the flexible brake band. The stud 32 projects slidably through a suitable opening in a plate 35 which is rotatably connected by a pivot pin 36 to the lever 26. The portion of the stud which projects below plate 35 is encircled by a spring 38 which is compressed between the plate 35 and a suitable washer 39 attached to the lower end of the stud by a nut 40. The spring normally urges the head 33 of the stud against the upper side of the plate 35.

The wire is paid from spool 10 over a first sheave 41 which is supported for rotation and for axial travel on a spindle 42 supported by a pillow block 43 on the frame. The wire is trained in a direction-reversing bend about the first sheave 41 to remove the major proportion of the residual curvature resulting from the winding of the material on the spool. The wire is then guided to a set of second sheaves 44 mounted on a spindle 45 projecting from the frame from a pillow block support 46 in spaced relation to the first sheave as shown in Fig. 2. The several second sheaves comprising the set are coaxially arranged on spindle 45 for independent rotation, the innermost second sheave 44a being positioned at about the mid-plane of the spool 10. The set of second sheaves is secured against axial displacement on the spindle 45 by annular lugs 47.

The wire is trained from the first sheave 41 around the innermost sheave 44a of set 44 and then downwardly over the innermost sheave 48a of a third set of sheaves 48 which are rotatably supported on a spindle 49 projecting from the outer end of the lever 26. The third set of sheaves 48 is mounted for independent rotation in planes intermediate the planes of rotation of the corresponding sheaves of the second set. From the innermost sheave 48a, the wire is trained upwardly in a direction-reversing bend and then over sheave 44b, etc. in successive convolutions about the additional sheaves of the second and third set. Any number of second and third sheaves may be provided, the number of second sheaves in each case, however, exceeding by one, the number of third sheaves. After being trained over the outermost second sheave 44d, the wire passes toward the equipment where it is utilized.

This let-off may be advantageously used in hose manufacturing machines wherein a great number of individual wires or other filaments are processed into reinforcing plies for hose. By means of this equipment the tension in these wires may be accurately regulated. A let-off of the type described herein is used for each wire to provide the desired tension regulation.

During periods in which the let-off is not operating to pay wire from the spool 10, the wire is maintained under tension while trained to the processing equipment by the weight of lever 26. Under these conditions the lever 26 will assume a position substantially as shown in Fig. 1, the exact position being determined by the spring rate of spring 38 which will be compressed by the lever, and the brake band 20 will be snubbed tightly about the brake drum 16 to prevent rotation of the spool.

In operation, during the brief interval in which the feeding speed of the wire is accelerated to its normal speed the tension in the wire will be increased abruptly. The lever 26 is therefore swung upwardly toward the sheaves 44 and wire is initially fed forwardly from the quantity wrapped between the sheaves 44 and sheaves 48. The upward movement of lever 26 permits the spring 38 to expand, gradually relieving the braking pressure of

3

the brake band so that the initial high tension force in the wire acts directly against spool 10 and starts it rotating. When normal feeding speed is reached the lever 26 will be elevated to a position in which the brake band 20 is fully released from the brake drum and the spool rotates freely on the spindle 11. Since the effective force movement of the lever is practically constant at any position in the path through which the lever swings, the lever exerts a substantially uniform tension on the wire.

During operation in which the wire is payed out at uniform speed, the lever 26 tends to "float" between an upward position in which the pressure of the brake band 20 is fully relieved and a more lower position where the brake band is snubbed lightly against the brake drum. If conditions are such that tension in the wire is suddenly relieved, the lever will immediately swing downwardly to lengthen the convolutions of wire about the sheaves 44 and 48, and snub the brake band 20 against the brake drum 16, thereby retarding the rotation of the spool. In accomplishing this, however, the downward movement of lever 26 is cushioned by the spring 38 so that regardless of how abrupt the change in tension is, the rotational speed of the spool is gradually braked. This advantageously prevents the transmittal to the wire of shock forces which may have sufficient magnitude to break the wire.

Whenever the operation of feeding the wire is stopped, the lever 26 immediately drops to a lower position to brake the rotation of the spool in the manner described in the preceding paragraph.

One of the features of this let-off which makes it highly sensitive is that in paying off the wire, the spool rotates in a counter-clockwise direction as shown in Fig. 1. Thus the "high" tension portion of the brake band 20 is the portion connected by the spring mechanism 25 to the lever 26 with this construction a proportion of the force exerted by the wire on the spool when the brake band is snubbingly engaged with the brake drum is exerted on the lever lending to swing the lever upwardly. This insures that the brake will be fully released as soon as the lever reaches a predetermined upward position and avoids the possibility of the brake band exerting a retarding drag on the brake drum which might occur if the rotational direction of the spool were reversed. Also the

4

lever is therefore sensitive to the tension effects of the portions of the wire near the spool as well as in the convolutions about sheaves 44 and 48.

Variations in the embodiment described may be made within the scope of the appended claim.

I claim:

A let-off for flexible filamentary material such as fine flexible wire, the let-off comprising a frame, means on the frame for supporting a supply spool for rotation to pay off material from the spool, a lever pivotally mounted on the frame and about which material paying from the spool is trained for exerting a constant static load on the material, the lever having an elevation relative to the spool variable with changes in tension in the material resulting from the rate at which it is payed from the spool, a brake drum rotatable with the spool, a brake band peripherally engaging the brake drum, said brake band having one end anchored to the frame and being trained from said anchored end about said brake drum in a direction counter to said rotational direction of said brake drum when said spool is paying out material, and spring means connecting the opposite end of said brake band to said lever, and comprising a rod fastened to said opposite end of the band, a plate pivotally attached to said lever and having a hole therein through which said rod slidably extends, and a spring biasing said rod axially through said hole in a direction tending to maintain said brake band snubbed on said brake drum, said spring maintaining snubbing engagement of said brake band throughout a predetermined range of movement of said lever toward the supply spool.

References Cited in the file of this patent

UNITED STATES PATENTS

1,031,487	Taylor	July 2, 1912
1,462,604	Lavalle	July 24, 1923
1,946,313	Daniels	Feb. 6, 1934
2,123,936	Dreyfus et al.	July 19, 1938
2,263,278	Senna	Nov. 18, 1941
2,419,808	Wirth	Apr. 29, 1947
2,578,620	Wilhelm	Dec. 11, 1951
2,589,366	Ganthier	Mar. 18, 1952
2,766,945	Reich	Oct. 16, 1956