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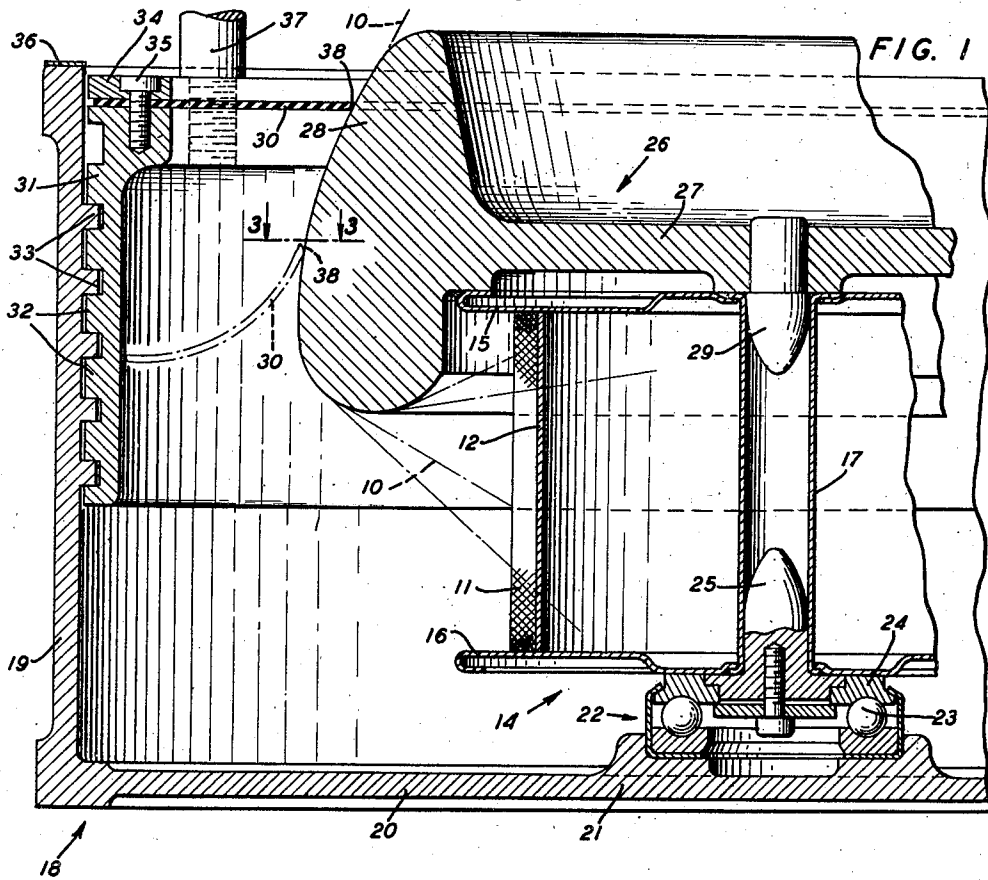
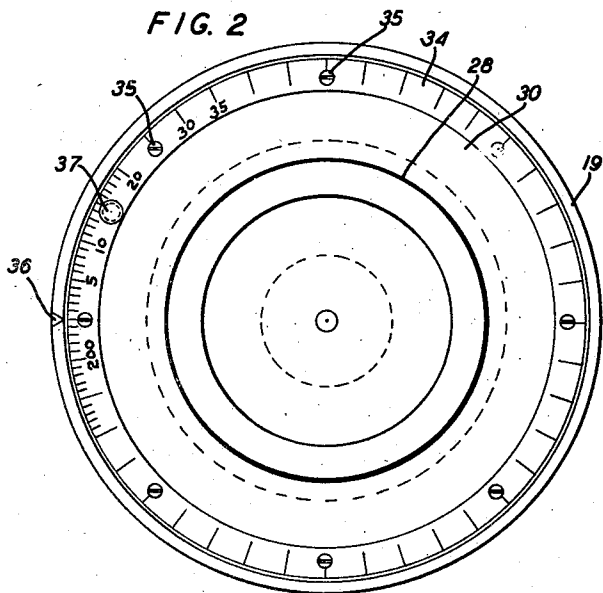
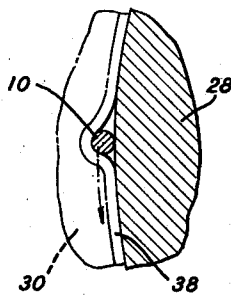
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STRAND TENSIONING APPARATUS

Filed Aug. 28, 1945

2 Sheets-Sheet 1



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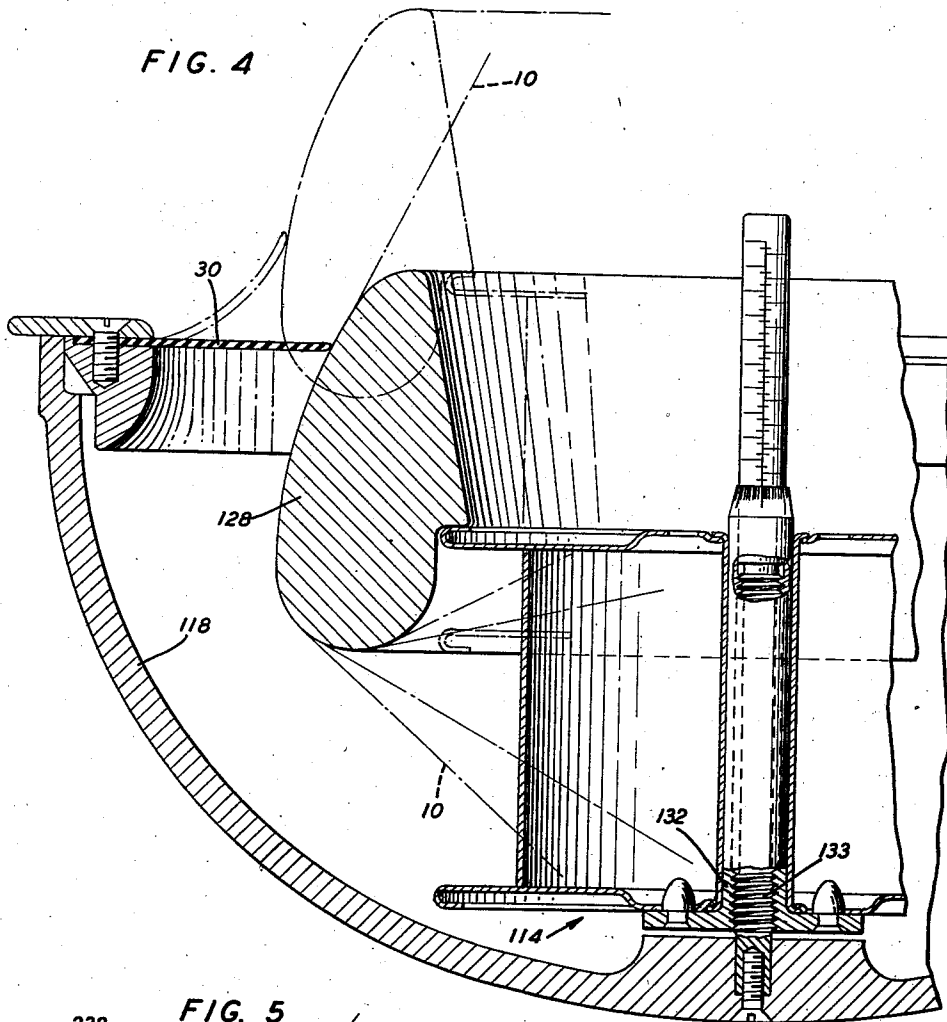
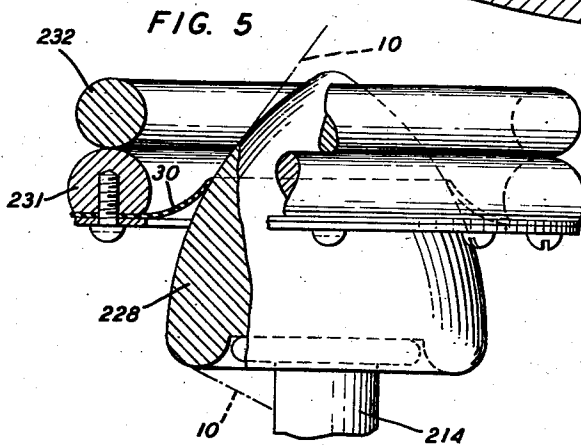
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STRAND TENSIONING APPARATUS

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2 Sheets-Sheet 2



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STRAND TENSIONING APPARATUS

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6 Claims. (Cl. 242-45)

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This invention relates to strand tensioning apparatus, and more particularly to a device for imposing a delicately adjustable constant tension upon a wire or other strand being drawn off a stationary spool or reel over one head thereof.

In a great many arts dealing with the treatment or utilization of wires, threads, cords or, in short, material in almost any kind of strand form, the strand to be operated on is drawn from a supply thereof wound on a spool or reel and is often simultaneously subjected to some kind of means resisting the advance of the strand in order to impose a certain predetermined degree of tension upon the strand, required to make the strand follow a prescribed path over guiding and operating elements thereafter. Innumerable devices have been invented or designed for the purpose of thus imposing a constant tension on a strand being drawn through the device against the resistance created thereby. Most frequently such devices depend upon some frictional effect, e. g. a friction brake means acting directly on the advancing strand itself or in a mechanism driven by the advancing strand. The true cause and nature of friction, however, are not yet well understood, although it is known that variation of both the temperature and the moisture content of the immediately circumambient atmosphere tend to affect frictional devices materially and oft unpredictably.

An object of the present invention is to provide means to control the motion of a strand being drawn off a stationary reel over one head of the reel and to effect a positive and adjustably invariable resistance to the motion of the strand without the employment of any significant frictional effect in the creation of the resistance.

With the above and other objects in view, the invention may be embodied in an apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having a strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member.

Other objects and features of the invention will

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appear from the following detailed description of one embodiment thereof, taken in connection with the accompanying drawing in which the same reference numerals are applied to identical parts in the several figures, and in which

Fig. 1 is a broken view in vertical central section of an apparatus constructed in accordance with the invention;

Fig. 2 is a detached plan view on a reduced scale of details thereof;

Fig. 3 is a broken enlarged sectional view on the line 3-3 of Fig. 1;

Fig. 4 is a view similar to Fig. 1 of a modified form; and

Fig. 5 is a smaller scale, broken view in side elevation of another form.

The apparatus disclosed as an illustrative embodiment of the invention in Figs. 1, 2 and 3, is an arrangement for controlling a wire 10 being drawn off from a coiled body 11 of wire on the barrel 12 of a reel generally indicated at 14 and having upper and lower heads 15 and 16 respectively, and an axial tube 17.

The apparatus comprises a can 18 having a cylindrical side wall 19 and a circular floor 20. In the center of the floor 20 is rigidly secured the lower raceway 21 of a ball bearing unit 22 whose upper raceway 24 runs on the balls 23. In the center of the upper face of the raceway 24 is rigidly secured an upstanding stub 25 whose lower portion is dimensioned to fit snugly but not tightly into the bore of the tube 17 of the reel 14, as shown, and whose upper portion is preferably ogivally pointed, as shown, to enable the reel to be easily placed down over it.

A reel having been placed in position in this manner, resting its lower head 16 supported on the raceway 24 and positioned coaxially thereon by the stub 25, a cap, generally indicated at 26, is placed resting on the upper head 15 of the reel. The cap 26 comprises a circular disk 27 having an integral (or rigidly attached) rim 28, overhanging the edge of the reel head 15 below and extending upwardly from and around the periphery of the disk 27 as shown. The outer surface of the rim 28 is formed, as shown, so that a strand leading thereto from any part of a layer of strand wound on the reel of average diameter of layers, will come to the surface of the rim 28 substantially tangentially thereto, and will leave the surface of the rim also tangentially when drawn off toward a point in the axis of the spool. The rim 28 is preferably made as hard and as brightly smooth as possible, e. g. with a plated and polished coating of chromium, so that fric-

tion on the strand passing thereover is reduced to an unimportant minimum. The cap 26 is provided centrally with a depending roundly pointed stub 29 to enter the tube 17 and thereby center the cap on the reel.

A flatly annular tension member 30, whose inner diameter is greater than the minimum diameter of the convex outer surface of the rim 28 but less than the maximum diameter of that surface is supported in position about the rim 28 on the upper annular surface of a cylindrical support 31, dimensioned to fit down into the can 18 and having on its outer surface a screw thread 32 engaging a corresponding thread 33 on the inner surface of the side wall 19 of the can. A washer 34 clamps the outer part of the member 30 in place on the support 31; and the support 31, member 30 and washer 34 are held together by screws 35. For convenience, the top annular face of the washer may be graduated as indicated in Fig. 2, and a pointer member 36 may be located on the stationary top of the wall 19 to coact therewith. Furthermore, a handle 37 may be secured to the top of the support 31 to turn the same in the can and thereby raise or lower the support 31 and therewith the annulus 30. The member 30 is made of some flexibly elastic material, e. g. soft, vulcanized rubber, so that the inner peripheral part of it is both elastically flexible and elastically extensible. Preferably also, the inner peripheral edge 38 is made toroidal.

Assuming now that a reel 14 of wire 10 to be unwound is in position as shown, and assuming further that the wire is being drawn upwardly off the reel toward some point above the reel and in the axis thereof, as indicated in Fig. 1, the tension member 30 may be dragged down over the rim 28 to some such position as that indicated in broken lines in Fig. 1, by rotating the support 31 with the handle 37. The member 30, by virtue of being stretched down over the rim 28 holds the latter frictionally against rotation, with respect to itself since the two are engaged all around the inner periphery of the member 30. The rim 28 thus being held against rotation and being massive and supported by the reel 14, holds the latter against rotation with respect to itself. Thus when the support 31 is held stationary, under ordinary circumstances by the mutual friction of the screw threads 32 and 33, the member 30, the cap 26 and the reel 14 are all held stationary on the ball bearing 22 against the relatively slight rotational drag of the strand being drawn off. Conversely, when the support 31 is turned in the can by the handle 37 to raise or lower the support and therewith the member 30, the reel 14 and cap 26 rotate freely on the bearing 22 and there is no relative rotational motion of the member 30 and rim 28.

As the wire 10 is pulled off the reel upwardly, the wire advances longitudinally of itself upwardly with an arc of line contact along the outer convex face of the rim 28. At the same time, the wire advances horizontally around the rim. As best shown in Fig. 3, the inner periphery of the member 30 lies against the wire in arcuate distortion having substantially only very small actual contact with the wire. The member 30 and the rim 28 being stationary, the wire proceeds around between them pushing the distortion around through the stationary substance of the elastic member 30, and thus doing work on the member 30. It is this work which offers the effective resistance to the motion of the wire and thus imposes the desired tension on the wire.

The friction of the wire over the extremely hard and polished surface of the rim 28 and against its substantially only line contact with the inner toroidal periphery 38 of the member 30 are practically negligible. The tension effected is not due to any frictional effect, but to the substantially constant work being done by the wire in deforming the member 30.

The rate of doing this work, and hence the tension imposed, can be adjusted by raising or lowering the member 30, in the manner described, and thus stretching the inner periphery thereof less or more severely against the rim 28. Thus the apparatus will impose a tension, continuously adjustably variable in amount and not in any material way dependent on or affected by any frictional effect.

In the arrangement shown in Fig. 4, the member 30 is mounted directly and non-adjustably on the upper rim of a can 118. In the axis of the can is a threaded shaft or spindle 133, supporting a correspondingly threaded sleeve 132 which in turn supports a reel 114. The wire guide cap is here reduced to the rim 128 alone, formed to rest on the top head of the reel. By revolving the rim 128 on its axis, the reel 114 and support 132 are forced to rotate on the spindle 133, and thus are adjusted up and down relatively to the stationary member 30. However, in this arrangement, there is rotary displacement of the members 30 and 128 with respect to each other while such adjustment is being made. In other respects this form is as satisfactory as that of Fig. 1.

A perhaps simplest form of embodiment of the invention is shown in Fig. 5. Here there is no can. The reel 214 rests on the floor. The strand guide is an ogivally conoidal mass 228 formed on its under side to fit snugly down on and over the top head of the reel. The member 30 is supported on the conoid 228 and has its outer periphery weighted by an attached toroidal mass 231. Adjustment of tension is effected by adding or reducing the weight applied by placing additional masses 232 on the weight 231 or removing the same.

The outer surface of the rim 28 is shown as a conoidal surface of revolution formed to the vertical curvature of the envelope of the various angular positions of the strand coming to the strand guiding surface from the reel below and also going to a variety of possible heights of intersection with axis of the reel above. However it will be understood that this is a preferred formation of this surface which may be variously modified, provided only that an upper circumference of less diameter and a lower circumference of greater diameter are joined by an intermediate belt which is not concave, i. e. which may be convexly bulging as shown, or could be conical instead of conoidal; so that by altering the relative vertical relation of the guide rim and the flexible elastic annulus 30, the tension imposing effect of the latter upon a strand drawn between them may be adjustably continuously variable between a minimum and a maximum value.

What is claimed is:

1. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having a strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and

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minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member.

2. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having an upwardly inwardly tapering strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member.

3. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having a convexly conoidal strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member.

4. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having a strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand

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guiding surface of the cap member and under the inner peripheral edge of the tension member, in combination with means to adjust the relative axial positions of the tension member and cap.

5. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having an upwardly inwardly tapering strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member, in combination with means to adjust the relative axial positions of the tension member and cap.

6. Apparatus to impose tension on a strand being drawn off over one head of a stationary reel, the said apparatus comprising a strand guide cap member to be supported on the specified head of the reel and to overhang the same peripherally and having a convexly conoidal strand guiding surface of revolution coaxial to the axis of the reel, and a flexible annular tension member with a central aperture of diameter intermediate between the maximum and minimum diameter of the cap member to engage coaxially on the cap member and to tension a strand drawn from the reel over the strand guiding surface of the cap member and under the inner peripheral edge of the tension member, in combination with means to adjust the relative axial positions of the tension member and cap.

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