

March 20, 1962

R. M. GOODWIN

3,026,064

FILAMENT TENSION REGULATING APPARATUS

Filed Sept. 11, 1956

2 Sheets-Sheet 1

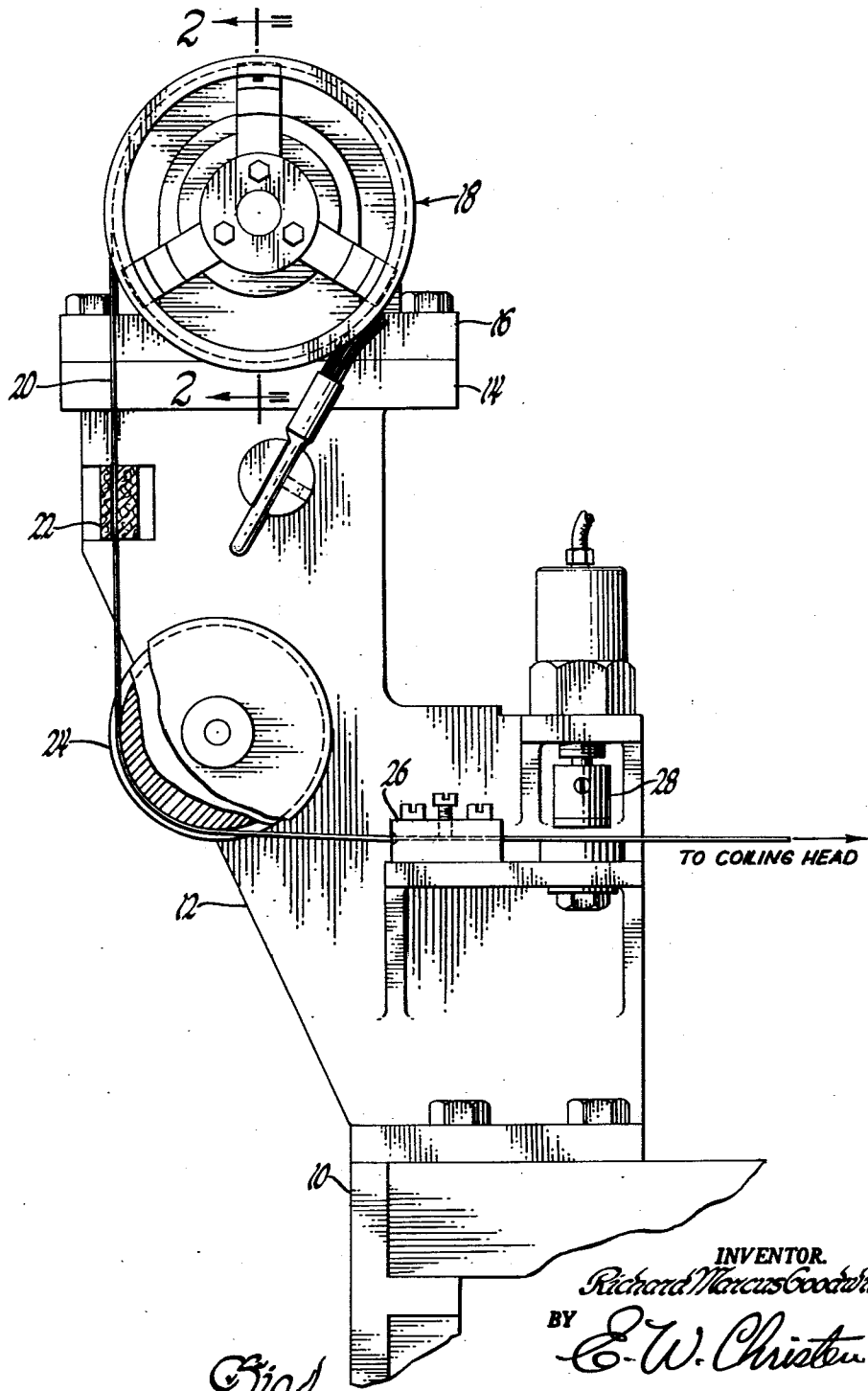


Fig. 1

INVENTOR.
Richard Marcus Goodwin
BY *E. W. Christen*
ATTORNEY.

March 20, 1962

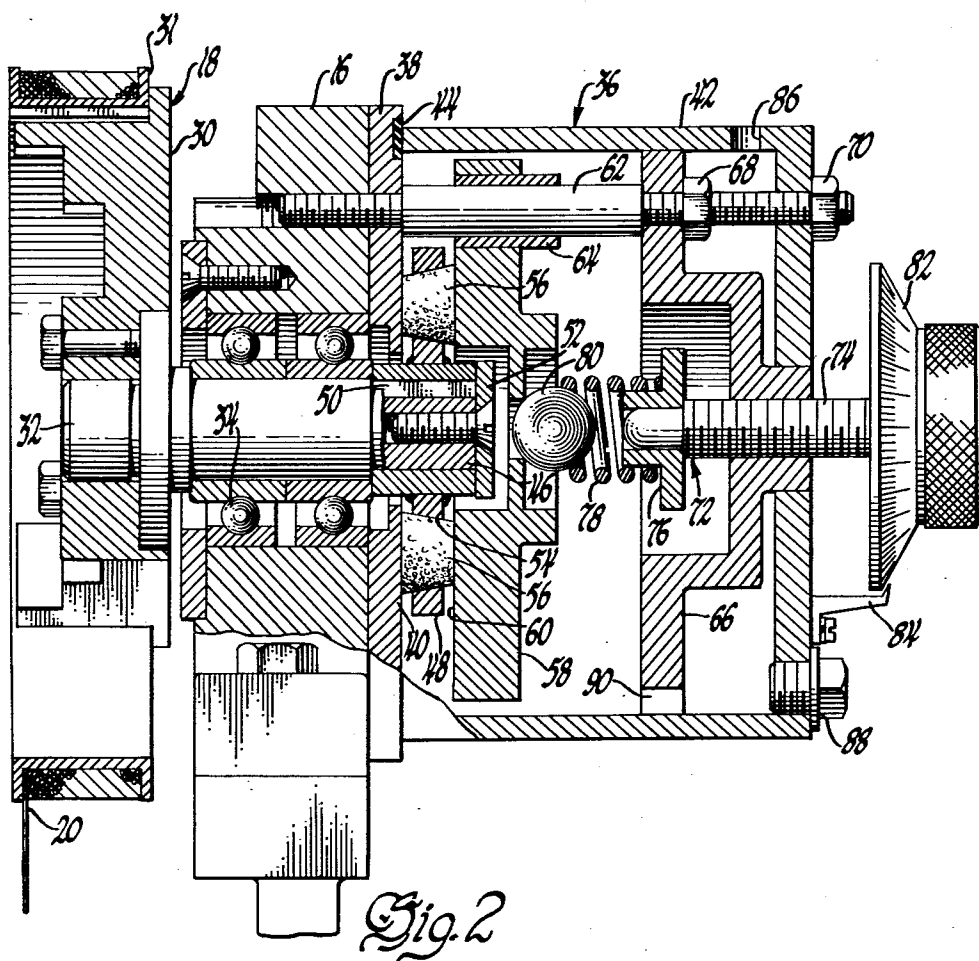
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INVENTOR
Richard Marcus Goodwin
BY *E. W. Christen*
ATTORNEY

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FILAMENT TENSION REGULATING APPARATUS
Richard Marcus Goodwin, Anderson, Ind., assignor to
General Motors Corporation, Detroit, Mich., a corpo-
ration of Delaware

Filed Sept. 11, 1956, Ser. No. 609,288

3 Claims. (Cl. 242—156)

This invention relates to means for developing restraining torque and more particularly to an improved tension regulating means for use in conjunction with filament supply reels.

In the manufacture of coiled filaments for electric incandescent lamps and similar devices, it is required to obtain accurate spacing of coil turns of each coil and exact uniformity among successive coils. One type of coiling machine adapted to meet these requirements utilizes a rotatable coiling head and mandrel upon which the coil is formed and a retractable wire guide for placing the filament wire in individual coil turns upon the mandrel. The filament wire is supplied from a rotatable supply reel and is unwound therefrom by the tension in the wire produced by the winding action of the rotatable mandrel. To ensure the desired uniformity, it is imperative that the tension in the filament be maintained at a predetermined constant value throughout the coiling operation.

Accordingly, it is an object of this invention to provide an improved friction brake for a rotative member which provides an accurately adjustable value of restraining torque.

Additionally, it is an object of this invention to provide an improved tension regulating device for a filament supply reel.

A further object of the invention is to provide a tension regulating device which may be fabricated from commercially available components and which permits regulation of restraining torque in the range of a few ounce-inches.

In accordance with this invention, a restraining torque of constant and accurately adjustable value is provided upon a rotatable shaft by a carrier rotatable therewith and supporting axially disposed frictional means. The carrier is disposed between a pair of reaction members which are relatively movable in an axial direction for compression of the friction means therebetween. Adjustable force exerting means urge the reaction members together and the entire assembly is immersed in a suitable lubricating medium.

A more complete understanding of the invention may be had from the detailed description which follows taken with the accompanying drawings in which:

FIGURE 1 is an elevation view of the filament supply mechanism incorporating the inventive tension regulating device.

FIGURE 2 is a sectional view taken on lines 2—2 of FIGURE 1 illustrating details of the inventive device.

Referring now to the drawings, there is shown an illustrative embodiment of the invention in a filament supply reel especially adapted for a filament coiling machine of the aforementioned type adapted for manufacture of incandescent lamp filaments. As shown in FIGURE 1, the coiling machine comprises, in general, a base member 10 upon which is supported a mounting bracket 12 for the filament supply mechanism. The mounting bracket 12 terminates in a lateral flange 14 to which is secured a journal housing 16 in which is rotatably mounted the filament supply reel designated generally at 18. The filament 20, which may be of a fine tungsten wire, extends from the supply reel 18 through a filament guide and wiping element 22 suitably secured to the mounting bracket 12. Thence, the filament 20 extends over an

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idler pulley 24 supported on the mounting bracket 12 to effect a change of direction of the filament and then through a guide block 26 and a filament clamping device 28 to the coiling head (not shown). As previously mentioned, the filament 20 is unwound from the supply reel 18 under the influence of the tension developed by the action of the coiling head and rotatable mandrel of the coiling machine.

In order to precisely regulate the tension produced in the filament, the supply reel 18 is subjected to a predetermined constant value of restraining torque. This is accomplished by the regulating device shown in detail in FIGURE 2. The supply reel 18 comprises a spider member 30 having radially extending arms which are adapted to receive at their outer ends a detachably mounted spool 31 containing the supply of filament 20. The spider 30 is non-rotatably secured to the hub of the reel shaft 32 which is journaled in the anti-friction bearings 34 in the journal housing 16.

It is noted that the spool 31 is of small radial dimension and, accordingly, for a given unwinding force on the filament the torque on the reel is substantially independent of the quantity of filament in the spool. Stated otherwise, the variation in filament tension is negligible, as the quantity of filament on the spool diminishes. Therefore, filament tension may be maintained constant by developing a fixed value of restraining torque on the supply reel.

In order to apply the desired restraining torque to the reel shaft 32 there is provided the regulating device, designated generally at 36. The regulating device comprises a fixed reaction member or plate 38 having a flat and smooth surface 40. A housing or casing 42, suitably cylindrical, is in abutment at its open end with the plate 38 and forms a fluid tight seal therewith through the intermediary of an annular sealing gasket 44. The plate 40 defines a central opening through which projects an extension of the reel shaft 32 having a shank portion 46. A carrier member or plate 48 is mounted for rotation with the shank portion of the reel shaft 32 by any suitable means such as the key 50. The carrier member 48 is secured against axial movement on the reel shaft by an end plate and screw assembly 52.

Disposed upon the carrier member 48 are friction means for developing a restraining torque on the reel shaft. The carrier member 48, suitably a circular plate, is provided with a plurality of axially extending openings 54 which are preferably spaced equally in a circumferential direction adjacent the periphery of the member. Each opening 54 is axially tapered and adjacent pairs of openings are tapered in opposite directions. The openings 54 are adapted to receive a plug-like element 56 of friction material which is axially tapered to correspond to the configuration of the openings. The friction elements 56 terminate in flat and parallel surfaces and suitably take the form of ordinary bottle stoppers of fine grain cork.

An adjustable reaction member or plate 58 is disposed adjacent the carrier member 48 and is provided with a flat and smooth surface 60. The reaction member 58 is non-rotatably mounted for axial movement upon a plurality of axially extending mounting bolts 62. The mounting bolts 62 are suitably three in number (one of which is illustrated in the drawings) and extend through reaction member 38 into screw thread engagement at their inner ends with the journal housing 16 for securing the regulating device 36 thereto. The mounting bolts have an enlarged intermediate portion forming a shoulder in abutment with member 38. The intermediate portion of each mounting bolt extends through the reaction member 58 and supports a guide sleeve 64 thereon to permit relative axial movement of the reaction member

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58. A support plate 66 is disposed adjacent the adjustable reaction member 58 and is provided with openings in alignment with the mounting bolts 62. The plate 66 is seated against the intermediate enlarged portion of the bolts and secured in place by a nut 68. The outer ends of the mounting bolts extend through the axial wall of the housing 42 and the housing is secured in place by nuts 70.

An accurately adjustable force is exerted on the axially adjustable reaction member 58 by a lead screw and spring assembly, designated generally at 72. This assembly comprises a lead screw 74 in threaded engagement with the support plate 66 and supporting a bushing 76 at its inner end. A compression spring 78 is seated at one end on the bushing 76 and on a ball member 80 at the opposite end. The ball member 80 is disposed in a central opening in the adjustable reaction member 58. The principal reason for utilizing the ball member 80 as aforementioned rather than direct abutting engagement, for example, between the compression spring 78 and the movable reaction member 58 is to avoid the imposition of a force on the reaction member 58 which has been found to cock the latter resulting in a binding action between the guide sleeves 64 embracing the intermediate portions of the bolts 62. Thus, the force of spring 78 is imposed on the reaction member 58 through the ball member 80 disposed in the aforementioned central opening in the adjustable reaction member 58 to enable the latter to adjust as required to avoid any binding action at the bolts 62 so as to be freely axially movable thereon. The lead screw 74 is provided at its outer end with a calibrated knob 82 disposed adjacent a fixed index member 84 which is suitably affixed to the housing 42 and is provided with axially spaced calibration marks. As will be apparent, the calibration marks on the index member 84 indicate the number of complete rotations of the lead screw 74 and the calibration marks on the dial 82 indicate the fractional part of a rotation of the lead screw 74. If desired, the indicating means may be calibrated directly in inch-ounces or other suitable units of torque.

The fluid tight housing 42 is adapted to be filled with a suitable lubricating medium such as a light machine oil to immerse the friction elements 56 and the surfaces 40 and 60 in lubricant. This is effective to ensure a constant value of frictional coefficient of the friction elements 56 and surfaces 40 and 60. Accordingly, the housing 42 is provided with a lubricant filler opening 86 at the upper portion and a drain plug 88 at the lower portion. The support plate 66 defines a lubricant passage or port 90 to facilitate filling of the housing with lubricant.

The operation of the regulating device will now be apparent. With the housing 42 suitably filled with lubricant, the desired tension in the filament is selected by adjustment of the control knob 82. This adjustment advances or retracts the lead screw 74 to vary the force exerted by the spring 78 on the adjustable reaction member 58. Under the influence of spring force the reaction member 58 is urged toward the fixed reaction member 38 and the friction elements 56 are compressed therebetween. In the rotation of the reel shaft 32 by unwinding of the filament 20, the restraining torque of the selected value is transmitted from the friction elements 56 to the carrier member 48 and thence to the reel shaft 32.

Although the description of this invention has been given with respect to a particular embodiment, it is not to be construed in a limiting sense. Many variations and modifications within the spirit and scope of this invention will now become apparent to those skilled in the art. For a definition of the invention, reference is made to the appended claims.

What is claimed is:

1. A torque regulating device comprising a support

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member, a shaft mounted for rotation on the support member, a fixed reaction plate having a portion coaxial with the shaft, an axially movable non-rotatable reaction plate adjacent the fixed reaction plate, said plates having opposed axially spaced flat surfaces, a carrier interposed between said surfaces and secured to the shaft for rotation therewith, said carrier defining plural axially extending openings adjacent its periphery, adjacent pairs of said openings being tapered in opposite directions, a tapered friction plug disposed in each of said openings and extending into engagement with the opposed surfaces of said reaction plates, a housing secured to the support member and enclosing said carrier and reaction members, a lubricating liquid substantially filling said housing and immersing the plugs, a lead screw mounted in said housing in alignment with the shaft, and a spring interposed between the lead screw and the movable reaction plate whereby the plugs may be compressed with adjustable force between said surfaces non-lockingly restraining rotation of said shaft.

2. A torque regulating device comprising a support member, a shaft mounted for rotation on the support member, a fixed reaction plate adjacent the support member and having a portion coaxial with the shaft, an adjustable reaction plate in axial alignment with the fixed plate, said plates having opposed axially spaced flat surfaces, a carrier interposed between said surfaces and secured to the shaft for rotation therewith, said carrier defining plural axially extending openings adjacent its periphery, adjacent pairs of said openings being tapered in opposite directions, a tapered friction plug disposed in each of said openings and extending into engagement with said surfaces, a housing enclosing said carrier and reaction members, securing means extending axially through said housing and the adjustable reaction plate into the support member to prevent rotation of the adjustable reaction plate and to provide a sealing engagement of the housing and fixed reaction member, a lubricating liquid substantially filling said housing, a lead screw mounted in said housing in alignment with the shaft, said adjustable reaction plate defining a central opening, a ball seated against the adjustable reaction plate in said central opening, and a spring interposed between the leadscrew and the ball whereby the plugs may be compressed with adjustable force between said surfaces non-lockingly restraining rotation of said shaft.

3. A torque regulating device comprising a rotatable shaft, a carrier mounted on said shaft, said carrier defining plural axially extending openings adjacent its periphery, adjacent pairs of said openings being tapered in opposite directions, a tapered friction plug disposed in each of said openings and extending on opposite sides of said carrier, a fixed reaction member engageable with said friction plugs on one side of said carrier, an axially movable non-rotatable reaction member engageable with said friction plugs on the opposite side of said carrier, and adjustable force-exerting means connected with said movable reaction member for urging the reaction members into axial engagement with said friction plugs to non-lockingly restrain rotation of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

817,180	Metten	Apr. 10, 1906
1,062,860	Stahl	May 27, 1913
2,232,966	Peterson	Feb. 25, 1941
2,277,134	Nelson	Mar. 24, 1942
2,321,525	Schroeder	June 8, 1943
2,462,766	Olson et al.	Feb. 22, 1949
2,498,123	Hobbs	Feb. 21, 1950
2,620,901	Stearns	Dec. 9, 1952
2,796,222	Frankel	June 18, 1957