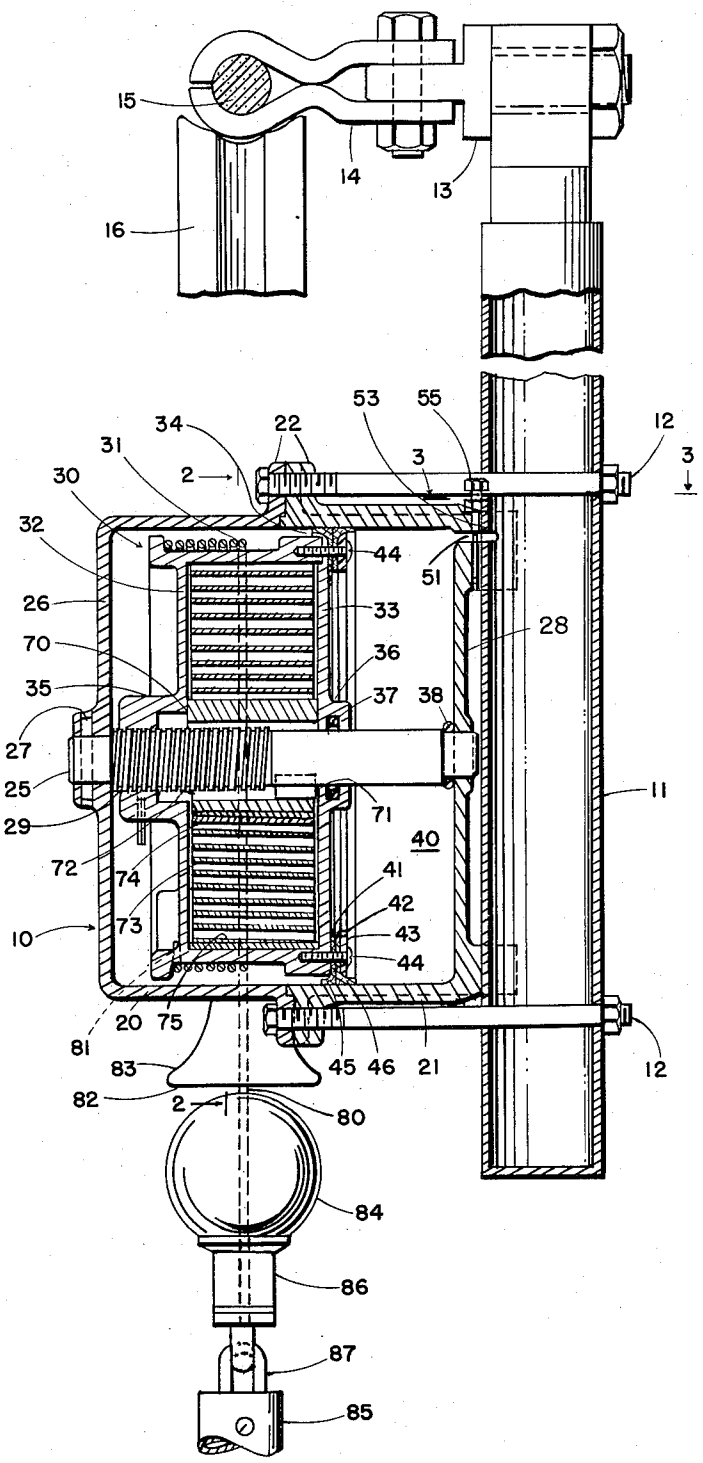
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REELING DEVICE

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FIG. 1



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REELING DEVICE

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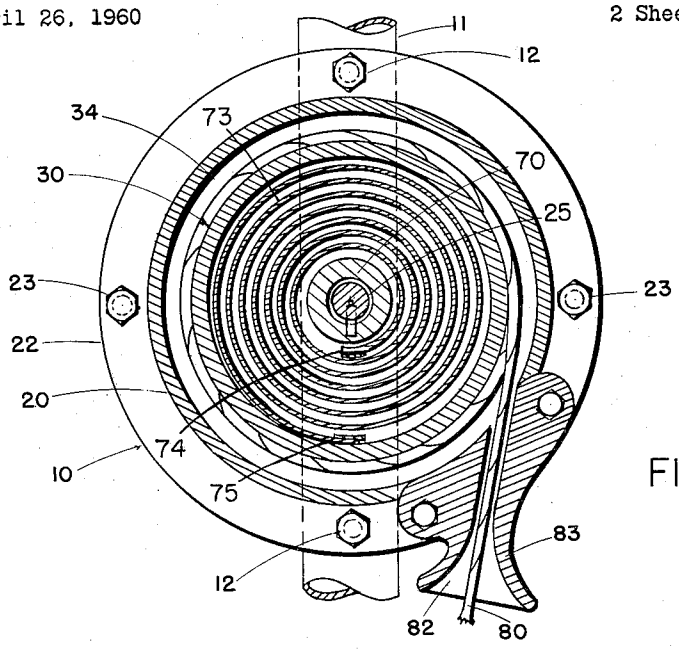



FIG. 2

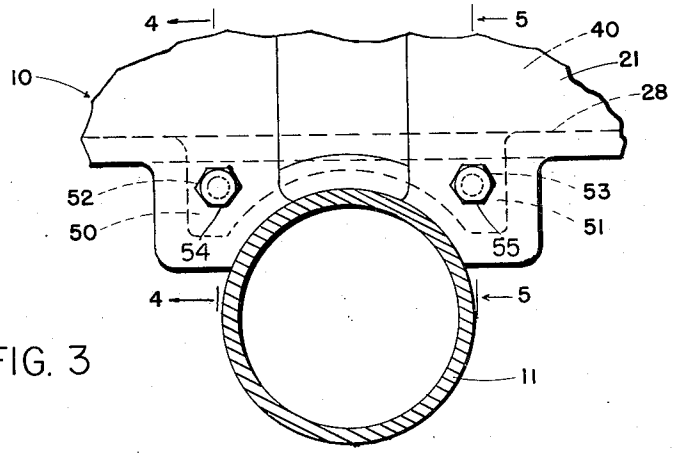



FIG. 3

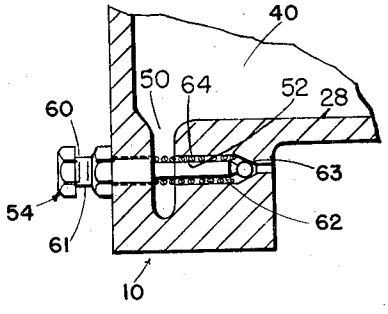



FIG. 4

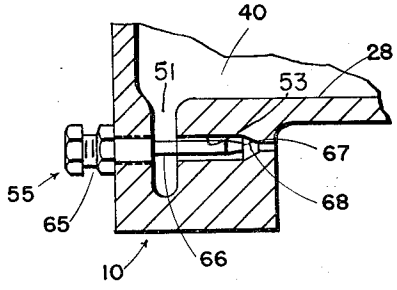



FIG. 5

United States Patent Office 3,041,044 Patented June 26, 1962



3,041,044

# REELING DEVICE

John E. Nixon, Langhorne, Pa., assignor to The Colorado Fuel and Iron Corporation, Denver, Colo., a corporation of Colorado

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10 Claims. (Cl. 254—160)

This invention relates to a reeling device and more particularly to such a device which is adapted to reel in or pay out a line at a controlled rate.

There has been developed a reeling device for towing, lowering or supporting various things, such as skiers, hatch covers, fire escapes, etc., which is extremely effective in operation and highly efficient. Such a device is disclosed, for example, in Leroy Nixon Patent 2,594,484, issued April 29, 1952. Devices of this type customarily employ a spring biased reel or drum, the rotation of which is resisted by one or more brake shoes which are operated by one or more pneumatic cylinders and serve to control automatically the rate at which the line is reeled in, or payed out, or both.

Heretofore, primarily as a result of the particular construction and arrangement of the brake shoes and their pneumatic cylinders, difficulties were encountered in maintaining optimum braking pressure during the unwinding and rewinding of the drum. Particularly after long and repeated usage, these brake shoes and cylinders showed signs of wear which heretofore impaired some of the many advantages resulting from the use of devices of this type. In addition, such previous devices have employed a relatively large number of component parts, with the result that the manufacturing cost and the incidence of repair have been excessive for many applications.

One general object of this invention, therefore, is to provide a new and improved reeling device which is particularly adaptable for reeling in or paying out a line at a controlled rate.

More specifically, it is an object of this invention to provide such a reeling device wherein the degree of control over the line being reeled in or payed out is substantially unaffected by the wear of the various parts during repeated usage.

Another object of this invention is to provide a reeling device of the character indicated which is readily adjustable to vary the degree of control over the line to be reeled in or payed out.

Still another object of this invention is to provide a reeling device utilizing comparatively simple mechanical components which is economical to manufacture and thoroughly reliable in operation.

A preferred form of reeling device constructed in accordance with the present invention is shown in the accompanying drawings, in which:

FIGURE 1 is a vertical longitudinal sectional view of a reeling device constructed in accordance with the invention, together with a supporting hanger attached to a traveling overhead cable;

FIGURE 2 is a transverse sectional view taken along the line 2—2 in FIGURE 1;

FIGURE 3 is a sectional view taken along the line 3—3 in FIGURE 1, with certain parts broken away for purposes of clarity;

FIGURE 4 is a sectional view taken along the line 4—4 in FIGURE 3; and

FIGURE 5 is a sectional view taken along the line 5—5 in FIGURE 3.

Although reeling devices constructed in accordance with the invention have particular utility when used in connection with a ski tow, as shown in the drawings, these devices also may be employed advantageously for other



applications in which it is desirable to exercise a degree of control over the rate at which a line is payed out, or reeled in, or both. Thus, for example, such devices may be used as overhead supports for tools on an assembly line, for towing various articles, such as gliders, boats, etc., or for other towing uses.

Referring initially to FIGURE 1 of the drawings, there is shown a substantially cylindrical reel housing 10 which is maintained in fixed relationship with respect to one end of an elongated hanger 11, such as by bolts 12. The opposite end of the hanger is rotatably secured to a laterally extending arm 13. The arm 13 supports a clamp 14 which is affixed to an overhead tow cable 15. The cable 15 illustratively may be of the type employed in ski tows, aerial tramways, etc., and is adapted to move at constant speed along a path defined by suitable support means, such as sheaves 16, which are spaced therealong at appropriate intervals.

The housing 10 comprises two cup-shaped sections 20 and 21, each of which is provided with an annular flange 22. The flanges 22 are maintained in fixed relationship with each other by the hanger bolts 12 and by additional bolts 23 (FIGURE 2) extending therethrough.

Axially disposed in the housing 10 is a shaft 25, one end of which is affixed to the end wall portion 26 of housing section 20 by a pin 27. The opposite end of the shaft 25 is journaled in the end wall portion 28 of housing section 21. The portion of the shaft 25 adjacent the end wall 28 is smooth, while the opposite portion of the shaft is provided with threads 29 which extend from the approximate center of the shaft to the end wall portion 26.

Mounted for rotation about the shaft 25 is a drum 30 which is disposed within the housing 10 and includes a cylindrical portion 31 and two end walls 32 and 33. The drum portion 31 is concentric with the adjacent portion of the housing 10 and is of a diameter slightly less than that of the housing to provide an annular opening 34 therebetween. The drum side wall 32 has an internally threaded hub 35 which accommodates the threads 29 on shaft 25, while the drum side wall 33 includes a hub 36 disposed about the smooth portion of the shaft. The hub 36 is provided with an O-ring 37 to substantially prevent the passage of air between the drum and the shaft. A second O-ring 38 encircles the shaft adjacent the right end thereof, as viewed in FIGURE 1, to similarly prevent air flow between the shaft and the adjacent housing end wall 28.

In the position shown in the drawings, the side wall 33 of the drum 30 is spaced from the end wall portion 28 of the housing 10 and, together with the inner cylindrical surface of the housing, defines an enclosed air space 40. Positioned in the opening 34 immediately adjacent this air space are two flexible members 41 and 42 of substantially annular configuration. The members 41 and 42 illustratively may be fabricated of leather or other flexible material and are secured to the outer portion of the drum wall 33 by an annular plate 43 which is held in position by machine screws 44. The flexible member 41 is disposed immediately adjacent the drum wall 33 and includes an outer portion 45 extending into the opening 34. Portion 45 is bent over in a direction away from the air space 40, and its outer end engages the inner surface of the housing 10. The flexible member 42 rests against the member 41 and includes an outer portion 46 extending into the opening 34. The outer end of portion 46 likewise engages the inner housing surface and is bent over in a direction toward the air space 40 and away from the outer portion 45 of the flexible member 41.

As best shown in FIGURES 3 through 5, a pair of recesses 50 and 51 are provided in the end wall 28 of the housing 10 which each are open to the air in the space 40. The recess 50 is in open communication with an

aperture 52 which extends in a transverse direction to the exterior of housing 10, while an aperture 53 is in open communication with the recess 51 and similarly extends to the housing exterior.

The aperture 52 accommodates a ball valve 54 which includes a valve stem 60 having a threaded section 61 rotatably disposed in the adjacent portion of the housing. The stem 60 also is provided with an elongated section 62 of reduced diameter which, in the fully closed (FIGURE 4) position of the valve, engages a ball 63 in position to prevent the passage of air between the air space 40 and the housing exterior. Disposed around the stem section 62 is a coil spring 64 which abuts the stem section 61 at one end and the ball 63 at the other end, thereby urging the ball toward its closed position.

As best shown in FIGURE 5, the aperture 53 in communication with the recess 51 accommodates a needle valve 55. One section 65 of the valve 55 is threaded and is rotatably disposed in the adjacent portion of the housing 10, while the remaining valve section 66 forms an extension of the section 65 and includes a taper 67 in spaced relationship with a restricted portion 68 of the aperture 53. The spacing between the taper and portion 68 may be adjusted by rotating the valve 55 to thereby vary the passage of air between the air space 40 and the exterior of the housing, for purposes that will become more fully apparent hereafter.

Axially disposed along the shaft 25 (FIGURE 1) between the walls 32 and 33 of the drum 30 is a sleeve 70. The sleeve 70 is prevented from rotational movement about shaft 25 by means of a key 71 which is mounted on the shaft and is slidably disposed in an elongated keyway 72 in the sleeve. A coil spring 73 is mounted around the sleeve 70 between the drum side walls, and its inner end is affixed to the outer surface of the sleeve in any suitable manner, such as by a clamping plate 74. The opposite end of the spring 73 is secured to the inner surface of the drum portion 31 by a clamping plate 75.

A cable or line 80 is disposed about the cylindrical portion 31 of the drum 30, and one end of the line is fixedly secured to the drum as at 81. The opposite end of the line 80 extends through the flared opening 82 of a removable guide section 83 and is affixed to a rubber ball 84. As the line 80 is reeled in, the rubber ball 84 is adapted to strike the adjacent portion of the guide section 83 and thereby serve as a stop. A support 85 for the article to be towed, lowered, etc., is suitably affixed to the portion of the ball 84 opposite that adjacent the line 80, such as by a tubular member 86 and a pivotally mounted link 87.

When the device is used as a ski tow, a number of the hangers 11, together with their corresponding reels, are affixed at intervals along the tow cable 15, and the cable is drawn over its sheaves 16 at a relatively constant rate of speed. To position himself on the tow, the skier customarily grasps the ball 84 of one of the reels and adjusts the support 85, which illustratively may comprise a J stick or T bar, on his person. At this time, the cable 15 is moving relative to the reeling device, and the line 80 begins to pay out.

As the drum 30 rotates about the shaft 25 upon the paying out of the line, it also moves in an axial direction toward the housing and wall 28 by reason of the threads 29. As a result, a fitting motion is imparted to the drum with respect to the flared opening 82 which insures that the line is unwound smoothly without binding. The rotation of the drum 30 is opposed by the coil spring 73. The sleeve 70 moves axially with the drum but is prevented from rotational motion about the shaft 25 by the sliding key 71 and corresponding keyway 72.

Initially, as the line 80 pays out, the rotation of the drum 30 is resisted primarily by the tension in the spring 73. This tension is relatively slight, and little resistance is offered thereby to the movement of the line. As the drum begins to move axially toward the housing end wall 28, however, the air in the space 40 is compressed. The resulting pressure in space 40 acts against the flexible member 42 and urges it against the inner cylindrical surface of the drum. This action serves two functions. Thus, as the member 42 presses against the inner drum surface, an airtight seal is formed which prevents substantial leakage of air between the air space 40 and the opening 34 between the cylindrical portions of the drum and its housing. Additionally, the frictional forces created as the member 42 is urged against the drum serve as a brake and resist the drum's rotational movement and hence the paying out of the line 80. As the pressure in the air space 40 increases in response to the axial movement of the drum toward the housing end wall 28, these frictional forces likewise increase and offer an increasing resistance to the paying out of the line. Thus, prior to the time that the entire line has unwound from the drum, the skier begins to move slowly and smoothly with uniform acceleration until his rate of travel is equal to that of the tow cable 15, at which time the relative movement between the drum 30 and the shaft 25 stops.

When the line 80 is released, such as when the skier reaches the top of the tow, the line automatically is rewound on the drum 30 by reason of the coil spring 73. The spring 73 rotates the drum on the shaft 25, and the drum also moves in an axial direction away from the housing end wall 28. As the volume of the air space 40 increases, a partial vacuum is created which tends to draw both of the flexible members 41 and 42 inwardly toward the air space. The outer portion 46 of the member 42 is urged away from the inner cylindrical surface of the housing 10, while the outer portion 45 of member 41 is forced against this housing surface. As a result, an airtight seal is formed between the air space 40 and the opening 34, and the member 41 additionally provides a braking action which resists the reeling in of the line. This resistance opposes the acceleration which normally would result as the line is pulled in. Thus, any whipping back and forth of the line is eliminated, and as the line approaches the end of its travel, the ball 84 smoothly and gently comes to rest against the guide section 83, thereby substantially reducing the chances of possible injury to the skier or damage to the device.

The ball valve 54 initially is adjusted so that the stem section 62 is spaced from the ball 63, the ball being held against its seat by the tension in the spring 64. The needle valve 55 likewise is adjusted so that the taper 67 is spaced from the restricted aperture portion 68. During the paying out of the line, the increasing air pressure in the space 40 forces the ball 63 firmly against its seat, thereby preventing the passage of air through the aperture 52. However, the needle valve 55 permits a small quantity of the air in space 40 to bleed to the exterior of the housing 10 through the aperture 53.

As the line is reeled in, the ball valve 54 opens as soon as the external air pressure exerted on the ball 63 exceeds the resistance of the spring 64. The ball valve, together with the opened needle valve, thereby enable a small quantity of air to be drawn into the air space 40.

The resistance offered to the rotational movement of the drum 30 by the action of the air or partial vacuum in space 40 against the flexible members 41 and 42 is proportional to the rate at which the line 80 is payed out or reeled in. Thus, as the line is payed out, for example, at a relatively slow rate, the passage of air through the needle valve 55 reduces the pressure build-up in the space 40, with a corresponding reduction in the frictional forces available to resist rotation of the drum. As the line 80 is payed out at a more rapid rate, more compression is obtained in the air space 40, and greater frictional forces are available to retard the rotation of the drum. Similarly, the faster the line is reeled in, the greater will be the vacuum in space 40. The resulting increased frictional forces between the flexible member 41 and the inner surface of the drum housing provide a greater resistance to

the rewinding of the drum. The reeling device thus acts to cushion too rapid a movement of the line **80** during the rewinding thereof. This cushioning effect is substantially unaffected by the wearing of the various parts, such as the flexible members **41** and **42**, since it is almost entirely dependent on the forces exerted on these members by the pressure or partial vacuum in the air space **40**.

The reeling device readily may be adjusted to provide the desired resistance to rotational movement of the drum **30** during the paying out of the line, the reeling in thereof, or both. Thus, the resistance afforded as the line pays out may be varied by opening or closing the needle valve **55** an appropriate amount to thereby vary the rate of air flow from the air space **40** through the aperture **53** to the exterior of the housing **10**. Similarly, for a given setting of the needle valve, the ball valve **54** may be adjusted to vary the tension in the spring **64** as well as the innermost position of the ball **63**, thereby controlling the rate of air flow through the aperture **52** and hence varying the resistance to rotation as the line is reeled in. In this manner, the degree of resistance to the rotational movement of the drum **30** may be adjusted to almost any desired degree consistent with the purposes of the particular device being employed.

As indicated heretofore, reeling devices constructed in accordance with the invention have particular utility when used in situations in which it is advantageous to resist the rotation of the drum during both the paying out and the reeling in the line. In other good arrangements, such devices may be employed simply to serve as a brake during the unwinding of the line and not when it is reeled in, or it may be used as a brake only when the line is reeled in and not when it is payed out. Thus, for example, in certain types of towing operations or in other cases where it is primarily advantageous to resist rotation of the drum as the line is payed out, the air space **40** may be vented during rewinding, such as by rotating the ball valve **54** to its fully opened position. Conversely, in cases where braking is desired primarily during the reeling in of the line, such as when the device is to be used as a tool support on an assembly line, for example, the air space may be vented as the line is payed out.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions, of excluding any equivalents of the features shown and described, or portions thereof, it being recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. A reeling device, comprising, in combination, a shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto means for moving said drum in an axial direction as it rotates, housing means positioned in fixed relationship with said shaft and having a first portion thereof spaced without and substantially concentric with a portion of said drum, said housing means including an end wall in spaced relationship with said drum, and at least one flexible member disposed between said first portion and said drum portion, said flexible member being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions in response to axial movement of said drum relative to said end wall, said flexible member thereupon providing a substantially airtight seal between said first portion and said drum portion and retarding the rotational movement of said drum.

2. A device for paying out a line, comprising, in combination, a shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out said line, means responsive to the rotational movement of said drum for moving the same in an axial direction as it rotates, housing means positioned in fixed relationship with said shaft and having a first portion thereof spaced from and substantially concentric with a portion of said drum, said housing means including an end wall in spaced realtionship with said drum to define an air space therebetween, and at least one deformable member disposed between said first portion and said drum portion, said deformable member being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions to provide a substantially airtight seal therebetween, rotational movement of said drum as the line is payed out imparting axial movement to the drum in a direction to move the same toward said end wall to compress the air in said space and urge said deformable means into frictional engagement with said other portion to thereby retard said rotational movement.

3. A reeling device, comprising, in combination, a threaded shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out a line, said drum cooperating with the threads on said shaft so that the drum moves in an axial direction as it rotates, a spring positioned within said drum and urging said drum to reel in said line, housing means positioned on said shaft and having a first portion thereof spaced without and substantially concentric with a portion of said drum, said housing means including an end wall in spaced relationship with said drum to define an air space therebetween, and flexible means disposed between said first portion and said drum portion and adapted to provide a substantially airtight seal therebetween, said flexible means being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions, rotational movement of said drum as the line is payed out against the tension of said spring imparting axial movement to the drum in a direction to move the same toward said end wall to compress the air in said space and urge said flexible means into frictional engagement with said other portion, said flexible means thereupon retarding said rotational movement.

4. A device for paying out and reeling in a line, comprising, in combination, a shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out or reel in said line, means responsive to the rotational movement of said drum for moving the same in an axial direction as it rotates, housing means including a first portion disposed without and substantially concentric with a portion of said drum and including an end wall in spaced relationship with said drum, and deformable means adapted to provide a substantially airtight seal between said first portion and said drum portion, said deformable means being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions to provide a substantially airtight seal therebetween, rotational movement of said drum in one direction imparting axial movement thereto in a direction to move the same toward said end wall, said deformable means frictionally engaging said other portion as the drum moves toward said end wall, thereby resisting its rotational movement in said one direction, rotational movement of said drum in the opposite direction imparting axial movement thereto in a direction to move the same away from said end wall, said deformable means frictionally engaging said other portion as the drum moves away from said end wall to thereby resist its rotational movement in said opposite direction.

5. A device for paying out and reeling in a line, comprising, in combination, a threaded shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto pay out or reel in said line, said drum cooperating with the threads on said shaft so that the drum moves in an axial direction as it rotates, a spring urging said drum to reel in said line, housing means mounted on said shaft and having a first portion thereof spaced without and substantially concentric with a portion of said drum, said housing means including an end

wall axially spaced from said drum to define an air space therebetween, and deformable means disposed between said first portion and said drum portion, said deformable means being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions in response to both an increase and a reduction of the air pressure in said space, rotational movement of said drum as the line is payed out against the tension of said spring imparting axial movement to said drum in a direction to move the same toward said end wall to increase the air pressure in said space and urge said deformable means into frictional engagement with said other portion, said deformable means thereby resisting the rotational movement of said drum as the line is payed out, rotational movement of said drum as the line is reeled in by said spring imparting axial movement thereto in a direction to move the same away from said end wall to reduce the air pressure in said space and urge said deformable means into frictional engagement with said other portion, said deformable means thereby resisting the rotational movement as the line is reeled in.

6. A device as defined in claim 5 in which said housing means includes vent means for adjusting the pressure of the air in said air space, and hence the resistance to rotation of said drum.

7. A device as defined in claim 6 in which said vent means comprises a needle valve for venting said air space during the axial movement of said drum toward said end wall, and a ball valve for venting said air space during the axial movement of said drum away from said end wall, said ball valve including a valve stem and a spring member disposed about said stem for normally urging said ball valve toward its closed position.

8. A device for paying out and reeling in a line, comprising, in combination, a threaded shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out or reel in said line, said drum cooperating with the threads on said shaft to move the drum in an axial direction as it rotates, housing means including a first, substantially cylindrical portion spaced without and concentric with a portion of said drum and including an end wall in spaced relationship with said drum to define an air space therebetween, and a first and a second flexible member disposed between said first portion and said drum portion, each of said members being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions, said first flexible member being adapted to provide a substantially airtight seal between said portions as said drum is rotated in one direction to pay out said line and said second flexible member being adapted to provide a substantially airtight seal between said portions as said drum is rotated in another direction to reel in said line, rotational movement of said drum in said one direction imparting axial movement thereto in a direction to move the same toward said end wall to compress the air in said air space and urge said first flexible member into frictional engagement with said other portion, said first flexible member thereby resisting said rotational movement of said drum in said one direction, rotational movement of said drum in said other direction imparting axial movement thereto in a direction to move the same away from said end wall to form a partial vacuum in said air space and urge said second flexible member into frictional engagement with said other portion, said second flexible member thereby resisting said rotational movement in said other direction.

9. A device for paying out and reeling in a line, comprising, in combination, a threaded shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out or reel in said line, said drum cooperating with the threads on said shaft to move the drum in an axial direction as it rotates, a spring disposed about said shaft and urging said drum to reel in said line, housing means mounted on said shaft and having a first portion thereof spaced without and substantially concentric with the cylindrical portion of said drum, said housing means including an end wall in spaced relationship with said drum to define an air space therebetween, and a first and a second flexible member disposed between said first portion and said drum portion, each of said members being carried by one of said portions and adapted to be urged into frictional engagement with the other of said portions, said first flexible member providing a substantially airtight seal between said portions as said drum is rotated in one direction against the tension of said spring to pay out said line and said second flexible member providing a substantially airtight seal between said portions as said drum is rotated in the opposite direction by said spring to reel in said line, rotational movement of said drum in said one direction imparting axial movement thereto in a direction to move the same toward said end wall to compress the air in said air space and urge said first flexible member into frictional engagement with said other portion, said first flexible member thereby resisting the rotational movement of said drum in said one direction, rotational movement of said drum in said opposite direction imparting axial movement thereto in a direction to move the same away from said end wall to form a partial vacuum in said air space and urge said second flexible member into frictional engagement with said other portion, said second flexible member thereby resisting the rotational movement of said drum in said opposite direction.

10. A device for paying out and reeling in a line, comprising, in combination, a threaded shaft, a drum mounted on said shaft and adapted for rotational movement with respect thereto to pay out or reel in said line, said drum cooperating with the threads on said shaft to move the drum in an axial direction as it rotates, a spring disposed about said shaft within said drum and urging said drum to reel in said line, housing means mounted on said shaft and having a first portion thereof spaced without and substantially concentric with the cylindrical portion of said drum, said housing means including an end wall axially spaced from an end wall of said drum to define an air space therebetween, and a first and a second deformable member disposed between said first portion and said drum portion, each of said members being affixed to said drum portion and adapted to be urged into frictional engagement with said first portion, said first deformable member providing a substantially airtight seal between said portions as said drum is rotated in one direction against the tension of said spring to pay out said line and said second deformable member providing a substantially airtight seal between said portions as said drum is rotated in the opposite direction by said spring to reel in said line, rotational movement of said drum in said one direction imparting axial movement thereto in a direction to move its said end wall toward said end wall of said housing means to compress the air in said air space and urge said first deformable member into frictional engagement with said first portion, said first deformable member thereby resisting the rotational movement of said drum in said one direction, rotational movement of said drum in said other direction imparting axial movement thereto in a direction to move its said end wall away from said end wall of said housing means to form a partial vacuum in said air space and urge said second deformable member into frictional engagement with said first portion, said second deformable member thereby resisting the rotational movement of said drum in said opposite direction.

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