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(1 of 1)

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Fancher

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Spring retractable reel having a pneumatic retraction governor

Abstract

A spring retractable reel having a pneumatic retraction governor or air motor for regulating the rewind speed of a spool for taking up a line of material. For example, an air motor includes a rotor having vanes, a first port opening onto one side of the rotor, and a second port opening onto a second side of the rotor. A valve adjustably restricts a continuous flow of ambient air through the second port, and the valve defines an opening sized smaller than the first port. The rotation of the spool and the rotor are fixedly coupled together, for example, with a chain. When the spool rewinds the line of material, the rotor rotates, which in turn draws ambient air through the first port, a portion of which ambient air is restricted from exiting the second port due to the valve thereby compressing air within the air motor to regulate or limit the speed at which the spool rewinds the line of material.

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References Cited [\[Referenced By\]](#)

U.S. Patent Documents

[2521178](#)

September 1950

Meletti

[2662483](#)

December 1953

Smith et al.

2954190	September 1960	Le Clair
3193190	July 1965	Lindberg
3211396	October 1965	McQuillen
3282222	November 1966	Raufeisen at al.
4050855	September 1977	Sakamaki et al.
4173332	November 1979	DuLondel
4367863	January 1983	Dulondel et al.
4422583	December 1983	Maxner et al.
4434974	March 1984	LaCount
4446884	May 1984	Rader, Jr.
4452430	June 1984	Kankkunen
5135181	August 1992	Wesselink
5725199	March 1998	Yamamoto
6086007	July 2000	Till
6158684	December 2000	Hedlund
6234417	May 2001	Sauder et al.
6467713	October 2002	Watanabe et al.
6488224	December 2002	Hiebenthal
6619313	September 2003	Boughton et al.

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Claims

The invention claimed is:

1. A spring retractable reel which pneumatically governs the retraction of a line of material, the spring retractable reel comprising: a frame; a spool rotatably supported on said frame; a spring for biasing said spool to take up the line of material; an air motor mounted on said frame, said air motor comprising: a housing having a chamber therein; a rotor having an axial shaft and a plurality of vanes, said rotor being eccentrically disposed relative to said chamber of said housing; a first port in communication with ambient air and opening into said chamber on a first side of said rotor; and a second port in communication with ambient air and opening into said chamber on a second side of said rotor; an adjustable valve for adjustably restricting a flow of ambient air through said second port, said valve defining a second sized opening sized smaller than a first sized opening of said first port; a first sprocket mounted on spool for rotation therewith; a second sprocket mounted on said shaft of said rotor; a chain for fixedly coupling the rotation of said spool and said first sprocket to the rotation of said second sprocket in both an unwinding direction and a retraction direction, and said first sprocket being larger than said second sprocket; and wherein when the line of material is pulled off said spool in said unwinding direction, said spring is tensioned and said rotor rotates generally freely as a flow of ambient air is draw through said valve into said chamber and generally unrestricted out said first port into ambient air, and when said spool rewinds the line of material under the action of the spring in said retraction direction, said rotor rotates in an opposite direction, which in turn draws a flow of ambient air through said first port, a portion of the flow of the ambient air drawn through said first port being restricted from exiting said second port due to said valve thereby compressing air within said chamber to regulate the speed at which said spool rewinds the line of material.

2. The spring retractable reel of claim 1 wherein said valve comprises an adjustable pin.

3. The spring retractable reel of claim 1 further comprising the line of material disposable on said spool and wherein the line of material comprises a hose.

4. The spring retractable reel of claim 1 further comprising the line of material line disposable on said spool and wherein the line of material comprises an electrical cable.
5. A method for regulating a speed of retraction of a line of material, the method comprising: providing a spring retractable reel having the line of material, the spring retractable reel comprising: a frame; a spool rotatably supported on the frame; a spring for biasing the spool to take up the line of material; an air motor mounted on the frame, the air motor comprising: a housing having a chamber therein; a rotor having an axial shaft and a plurality of vanes, the rotor being eccentrically disposed relative to the chamber of the housing; a first port in communication with ambient air and opening into the chamber on a first side of the rotor; and a second port in communication with ambient air and opening into the chamber on a second side of the rotor; an adjustable valve for adjustably restricting a flow of ambient air through the second port, the valve defining a second sized opening sized smaller than a first sized opening of the first port; a first sprocket mounted on spool for rotation therewith; a second sprocket mounted on the shaft of the rotor; a chain for fixedly coupling the rotation of the spool and the first sprocket to the rotation of the second sprocket in both an unwinding direction and a retraction direction, and the first sprocket being larger than the second sprocket; and wherein when the line of material is pulled off the spool in the unwinding direction, the spring is tensioned and the rotor rotates generally freely as a flow of ambient air is draw through the valve into the chamber and generally unrestricted out the first port into ambient air, and when the spool rewinds the line of material under the action of the spring in the retraction direction, the rotor rotates in an opposite direction, which in turn draws a flow of ambient air through the first port, a portion of the flow of the ambient air drawn through the first port being restricted from exiting the second port due to the valve thereby compressing air within the chamber to regulate the speed at which the spool rewinds the line of material; dispensing the line of material from the spring retractable reel to tension the spring; retracting the line of material on the spool under the action of the spring; and regulating the flow of air out of the valve so that air in the air motor is compressed and the speed at which the line of material is retracted is regulated.
6. The method of claim 5 further comprising adjusting the valve to adjust the flow of air through the air motor thereby adjusting the speed at which the line of material is retracted.
7. A spring retractable reel which pneumatically governs the retraction of a line of material, the spring retractable reel comprising: a frame; a spool rotatably supported on said frame; a spring for biasing said spool to take up the line of material; a pneumatic retraction governor mounted on said frame, said pneumatic retraction governor having a house having a chamber therein, a rotor having a plurality of vanes, a first port having a first opening, and a second port; a valve for adjustably restricting a flow of air through said second port, said valve defining a second sized opening sized smaller than said first sized opening of said first port; means for fixedly coupling a rotation of said spool to a rotation of said rotor of said pneumatic retraction governor in both an unwinding direction and a retraction direction; and wherein when the line of material is pulled off said spool, said spring is tensioned and said rotor rotates generally freely as a flow of ambient air is draw through said valve into said chamber and generally unrestricted out said first port into ambient air, and when said spool rewinds the line of material under the action of said spring in the retraction direction, said rotor rotates in an opposite direction, which in turn draws ambient air through said first port, a portion of the flow of ambient air drawn through said first port is restricted from exiting said second port due to said valve thereby compressing air within said chamber to regulate the speed at which said spool rewinds the line of material.
8. The spring retractable reel of claim 7 wherein said means for fixedly coupling the rotation of the rotor is operable to rotate said rotor at a greater rate than the rate of rotation of said spool.
9. The spring retractable reel of claim 7 wherein said valve comprises an adjustable pin.
10. The spring retractable reel of claim 7 further comprising the line of material disposable on said spool and wherein the line of material comprises a hose.
11. The spring retractable reel of claim 7 further comprising the line of material disposable on said spool and wherein the lines of material comprises an electrical cable.
12. A method for regulating a speed of retraction of a line of material, the method comprising: providing a spring retractable reel having the line of material, the spring retractable reel comprising: a frame; a spool

striking a person or object.

One attempt at regulating the speed of the rewinding of a spring-loaded reel is U.S. Pat. No. 6,488,224 issued to Hiebenthal, which discloses a hydraulic braking mechanism or governor mounted on a spring-loaded reel for controlling the rate of rotation of the reel as the elongated member is wound upon the wheel. The governor or braking mechanism comprises a hydraulic gear pump which is mounted on the reel support and which includes an internal hydraulic circuit consisting of a variable metering valve which is used to control the free retraction speed of the spring-powered rewind reel. The restricted flow causes a resistance to rotation of the pump shaft of the hydraulic pump causing a braking force on the spring reel. A clutch bearing is provided to permit the freewheeling of the reel during the unwinding step.

U.S. Pat. No. 6,234,417 issued to Sauder et al. discloses a hose reel retractor with a unidirectional viscous speed governor comprising multiple disks housed in a chamber filled with a viscous fluid coupled to the reel to provide a retarding force that is proportional to velocity.

U.S. Pat. No. 6,086,007 issued to Till discloses a viscously damped cord retract. The system includes a spool, a spring, an air-damper member, and a housing member. The spool is adapted to receive and store varying lengths of a flexible member. The air-damper member is concentrically disposed in the spool and defines at least two rotatable air filled chambers or channels. The house member secures the spool and the air-damper member in a concentric enclosed airy arrangement. An airy chamber defines an enclosure that is not open to a free circulation of air but is penetrable by a limited volume of air.

U.S. Pat. No. 4,422,583 issued to Maxner et al. discloses a wire feeder having a dampening means to inhibit rotation of a reel of wire. The damping means includes a cylinder having a piston with a piston rod. A plurality of valves regulate the air in and out of the ends of the cylinder to dampen or brake the rotation of the reel shaft, and thus, dampen the inertia of the reel as it rotates.

U.S. Pat. No. 4,173,332 issued to DuLondel discloses a rotary speed limiter device particularly useful as a fire escape device. The device has a rotary speed limiter member mounted on a shaft to slide axially on the shaft and to rotate with it. Means, the speed of which is to be controlled, rotates the shaft. As the shaft is rotated, means applies a braking force on the speed limiter member, causing it to compress air in a surrounding support body and to move axially on the shaft, to limit the speed of the shaft rotating means.

Other non-spring-retractable reels have employed rewind motors, for example, which use compressed air and liquid for aiding the rewinding of the cable or hose.

There is a need for further spring-retractable reels and methods for regulating the rewind speed of the reel.

SUMMARY OF THE INVENTION

The present invention provides, in a first aspect, a spring retractable reel which pneumatically governs the retraction of a line of material. The spring retractable reel includes a frame, a spool rotatably supported on the frame, a spring for biasing the spool to take up the line of material, and an air motor mounted on the frame. The air motor includes a housing having a chamber therein, and a rotor having an axial shaft and a plurality of vanes. The rotor is eccentrically disposed relative to the chamber of the housing. A first port in communication with ambient air opens into the chamber on a first side of the rotor, and a second port in communication with ambient air opens into the chamber on a second side of the rotor. An adjustable valve is provided for adjustably restricting a flow of air through the second port. The valve defines a second sized opening sized smaller than a first sized opening of the first port. A first sprocket is mounted on the spool for rotation therewith, and a second sprocket is mounted on the shaft of the rotor. A chain fixedly couples the rotation of the spool and the first sprocket to the rotation of the second sprocket in both an unwinding direction and a retraction direction. The first sprocket is larger than the second sprocket. When the line of material is pulled off the spool reel, the spring is tensioned and the rotor rotates generally freely as a flow of ambient air is draw through the valve into the chamber and generally unrestricted out the first port into ambient air. When the spool rewinds the line of material under the action of the spring in the retraction direction, the rotor rotates in an opposite direction, which in turn draws a flow of ambient air through the first port, a portion of the flow of the ambient air drawn through the first port being restricted from exiting the second port due to the valve thereby compressing air within the chamber to regulate the speed at which

normally cause the cable or hose to be rewound on the reel at a high rate of speed.

FIG. 1 illustrates one embodiment of a spring retractable reel 10 in accordance with the present invention for dispensing and retracting a line of material (not shown) such as a hose, a cable, or other type of line of material. The illustrated spring retractable reel generally includes a frame 20, a spool 30 for holding the line of material, and an air motor 100 for regulating the rewind speed of the spring retractable reel.

Frame 20 generally includes a pair of spaced-apart vertically disposed plates 22 and a base 24. Spool 30 is supported on a shaft 40. The ends of shaft 40 are rotatably supported by bearings 45 (only one of which is shown in FIG. 1) attached to plates 22. It will be appreciated that other types and shapes of frames may be employed, e.g., frames or supports formed from round or square tube members. In addition, the frame may include wheels to allow the spring retractable reel to be readily moved from one location to another location.

A spring motor 50 includes a spring (not shown in FIG. 1) disposed in a cover 55. The cover is attached to the frame. One end of the spring is attached to the cover and the other end of the spring is attached to the shaft. The spring operably biases the spool to take up the line of material. The housing protects the spring and reduces the likelihood of risk of injury to an operator from the spring.

A first sprocket 35 such as a disc sprocket is mounted, e.g., using a plurality of bolts and nuts, on spool 30 for rotation therewith. First sprocket 35 is operably fixedly connected via a chain 60 to a second sprocket 37 which is attached to air motor 100. Air motor 100 is mounted on a mounting plate 26 which attaches to frame 20.

As shown in FIG. 2, air motor 100 generally includes a housing 110 having a chamber 112 therein, a rotor 120 attached to an axial shaft 122 and a plurality of vanes 124, end plates 130 and 132, and bearings 140 and 142. As best shown in FIGS. 3 and 4, rotor 120 may be eccentrically disposed relative to chamber 112 of housing 110 of air motor 100. With reference again to FIG. 2, a first port 150 opens into chamber 112 on a first side of rotor 120, and second port 160 opens into chamber 112 on a second side of rotor 120. Other components of the air motor may include various gaskets and seals disposed between the various components, and a plurality of springs for forcing the vanes outwardly from the rotor.

As described in greater detail below, the air motor is not used in the conventional manner to receive a supply of compressed air to act as a motor. Instead, the air motor is used to compress a flow of air through the air motor when the air motor is rotated in one of its two directions, and in doing so, acts to pneumatically govern the rewind speed of the spring retractable reel.

With reference again to FIGS. 3 and 4, the rotor rotates eccentrically in the chamber formed by the housing and the end plates. The rotor is off-center and its diameter is smaller than that of the chamber so that a crescent-shaped chamber is created. The rotor slots and vanes divide the chamber into separate working chambers of different sizes. As a result of the centrifugal force, which is often reinforced by the compressed flow of air, the vanes are forced against the cylinder wall to seal the individual chambers. The number of vanes in the air motor typically ranges between 3 and 10.

A suitable air motor is available from Gast Manufacturing Inc. of Benton Harbor, Mich., model number 4AM-NRV-143 which includes 8 vanes. While an air motor has been described above, other suitable pneumatic retraction governors may be employed in the spring retractable reel of the present invention. For example, other suitable pneumatic retraction governors may include, a rotary vane pump such as disclosed in U.S. Pat. No. 2,662,483 issued to Smith et al, a vacuum pump such as disclosed in U.S. Pat. No. 3,193,190 issued to Lindberg, a rotating machine as disclosed in U.S. Pat. No. 3,282,222 issued to Raufeisen et al., and air pump or compressor as disclosed in U.S. Pat. No. 4,050,855 issued to Sakamaki et al. The entire subject matter of these patents is incorporated herein by reference.

With reference again to FIG. 1, an adjustable valve 200 is attached to air motor 100 for adjustably restricting a flow of air through the second port. The valve defines a second sized opening sized smaller than the first sized opening of the first port. FIG. 5 illustrates one embodiment of the adjustable valve 200. For example, the adjustable valve may include an elongated outer housing 210 having an axial passageway 220 extending therethrough. The lower end 230 may have external threads for engaging internal thread disposed in the second port of the air motor. A plurality of holes or apertures 240 may extend from the outside of housing

constant irrespective of the ambient temperature. In comparison to a hydraulic regulator or governor, the viscosity of the hydraulic fluid will vary with temperature leading to variations in speed as the ambient temperature changes.

In addition, the present invention has a faster recovery than a hydraulic regulator or governor. Since air has very low viscosity, it can react more quickly to outside events, e.g., the speed of the spool, and counteract those forces almost instantly, whereas the hydraulic based solutions typically take longer to respond. For example, the air motor employed in the present invention will react quickly to slow down and maintain the speed of the retracting reel as compared to a hydraulic governors which are typically slow in reacting to slow down the retracting reel.

Further, the present invention does not require a one-way clutch bearing which are typically required on spring-retractable reels employing a hydraulic governor, since there is no viscous resistance to overcome when pulling a cable or a hose off the reel employing an air motor as a pneumatic governor as described above.

Although various embodiments have been depicted and described in detail herein, it will be apparent to those skilled in the relevant art that modifications, additions, substitutions and the like can be made without departing from the spirit of the present invention and these are, therefore, considered to be within the scope of the present invention as defined in the following claims.

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