United States Patent

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[54] **DRAGLINE WINCH FOR SKI TOWS AND THE LIKE**
7 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **104/173,** 242/107.3
[51] **Int. Cl.** **B61b 11/02,** B65h 54/02
[50] **Field of Search** 104/173; 188/134, 185; 242/107.3

[56] **References Cited**

UNITED STATES PATENTS

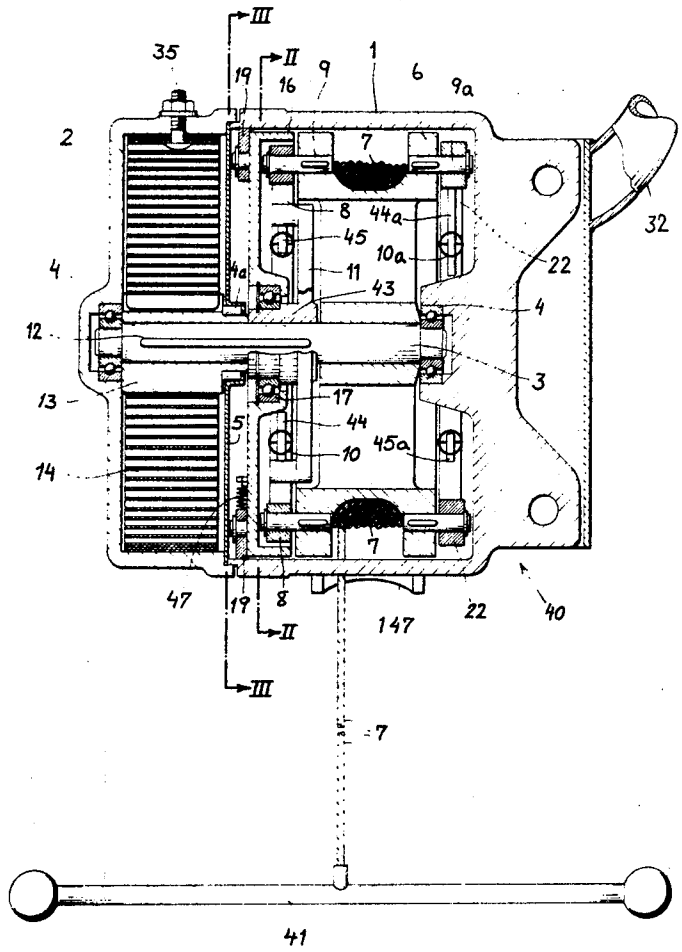
3,237,878	3/1966	Van Evera	242/107.3
3,439,627	4/1969	Carlevaro	104/173

FOREIGN PATENTS

542,762	11/1955	Belgium	188/134

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ABSTRACT: To couple a tow bar of a ski tow to a moving conveyor, the latter is fastened to a winch with a cylindrical housing wherein a shaft is rotatable against the restoring force of a spiral spring and carries a reel around which a cable anchored to the tow bar is wound. Tension on the cable activates a normally inoperative brake which is exclusively or more highly effective in the unwinding direction and progressively impedes rotation of the reel after overcoming a countervailing biasing force.



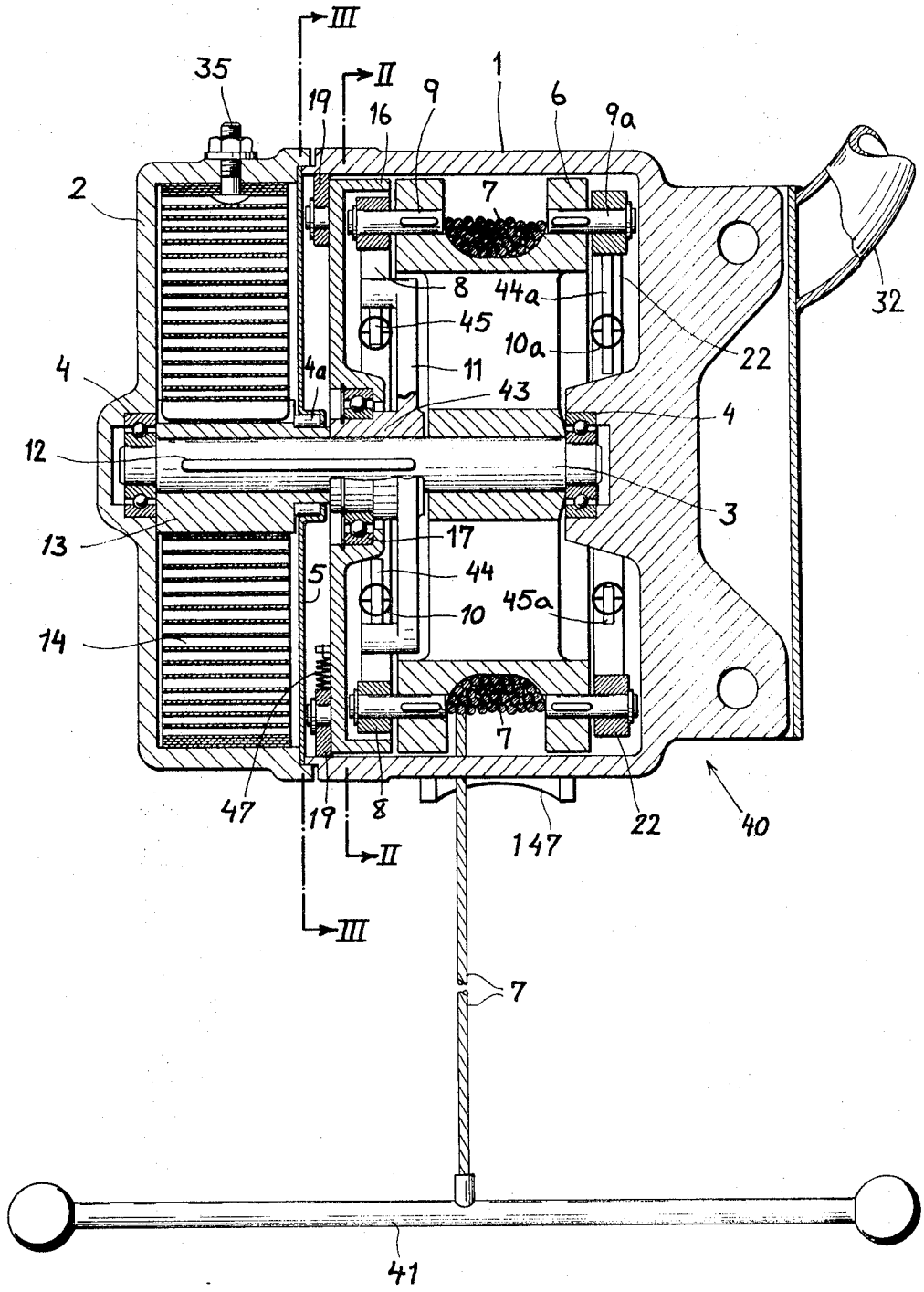


FIG. 1

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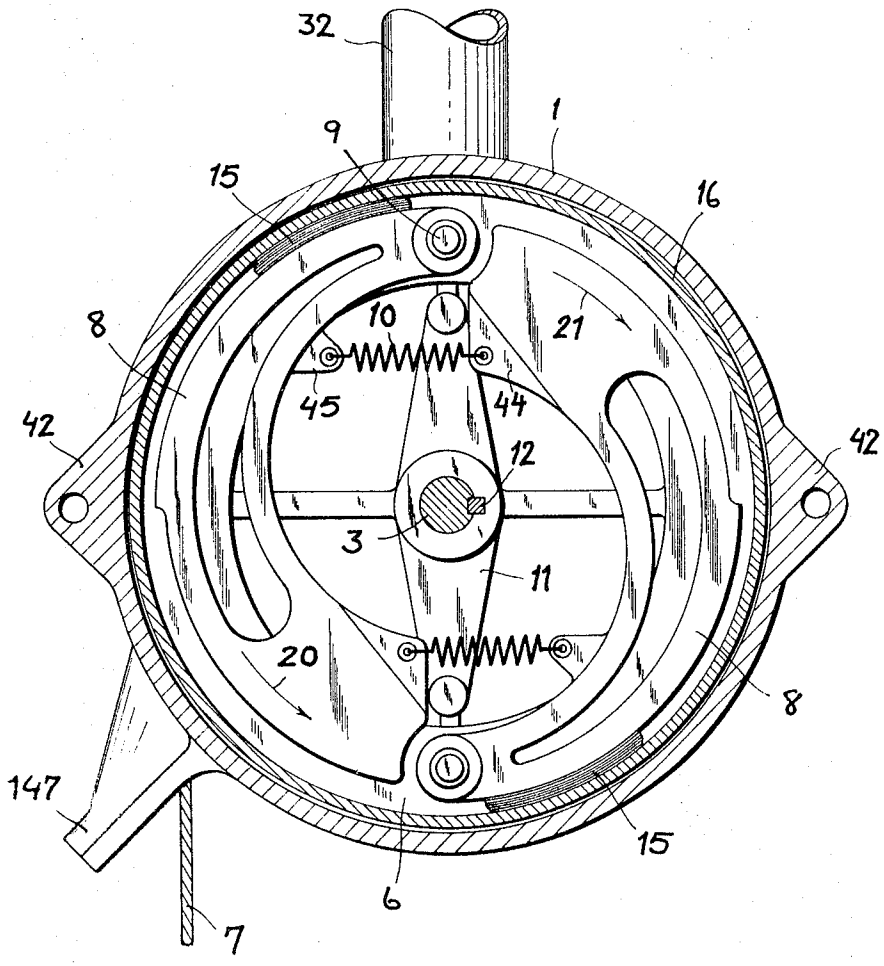


FIG. 2

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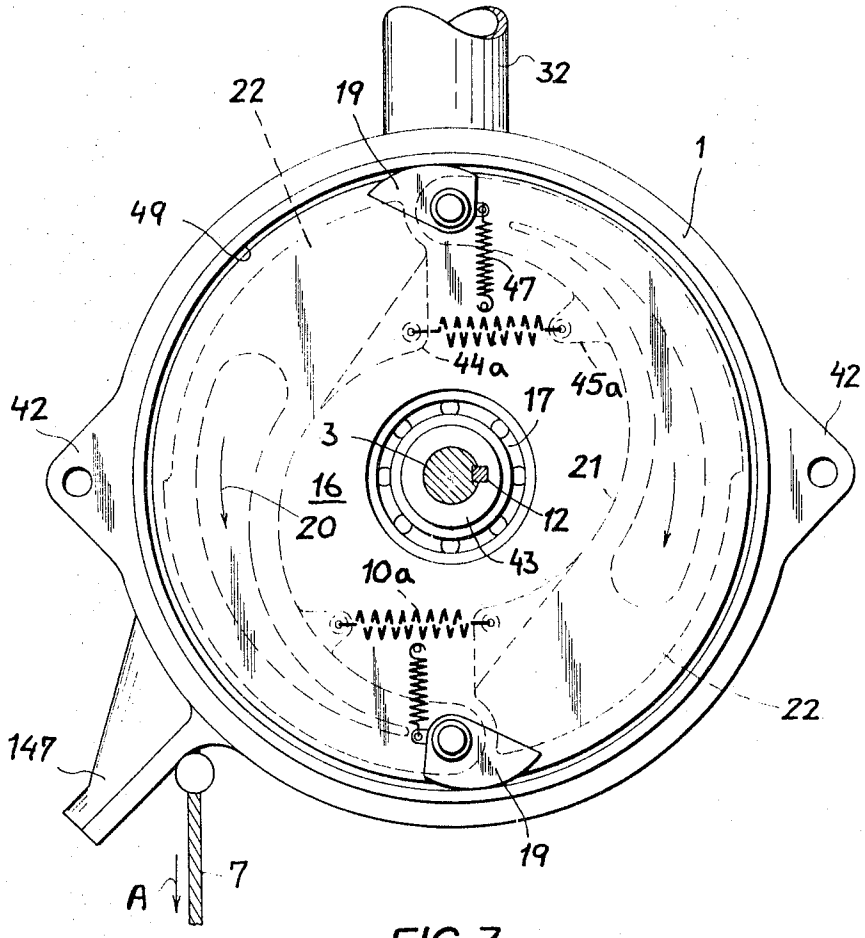


FIG. 3

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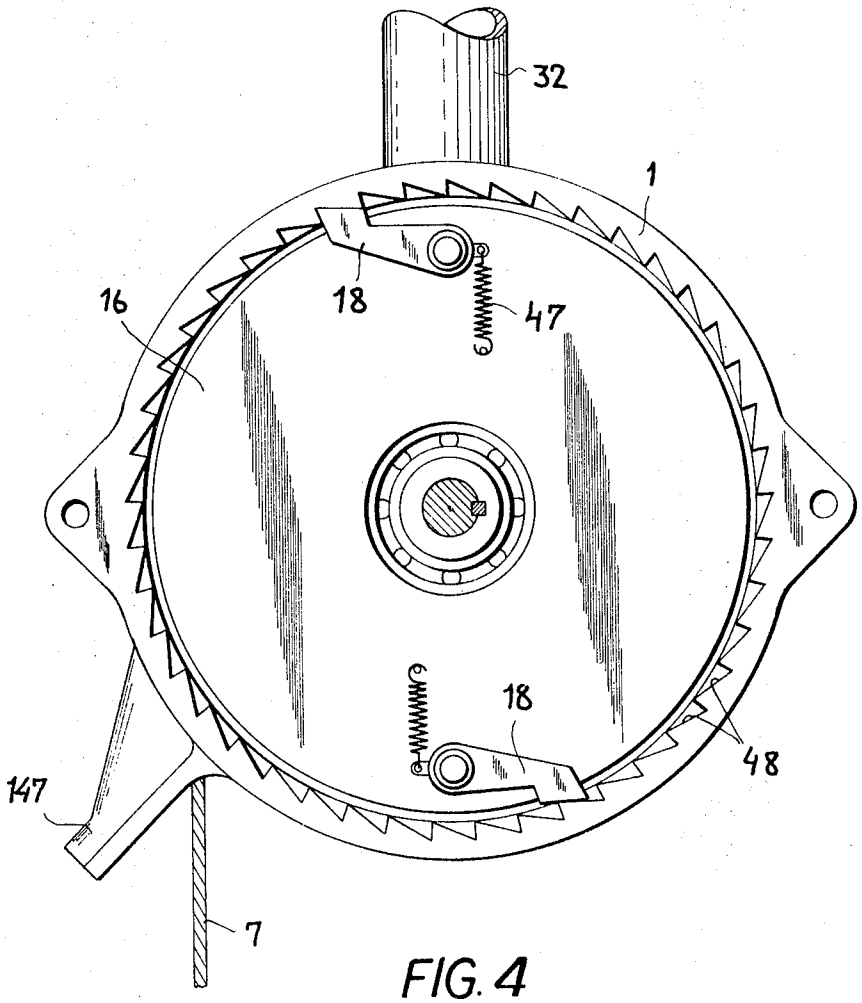


FIG. 4

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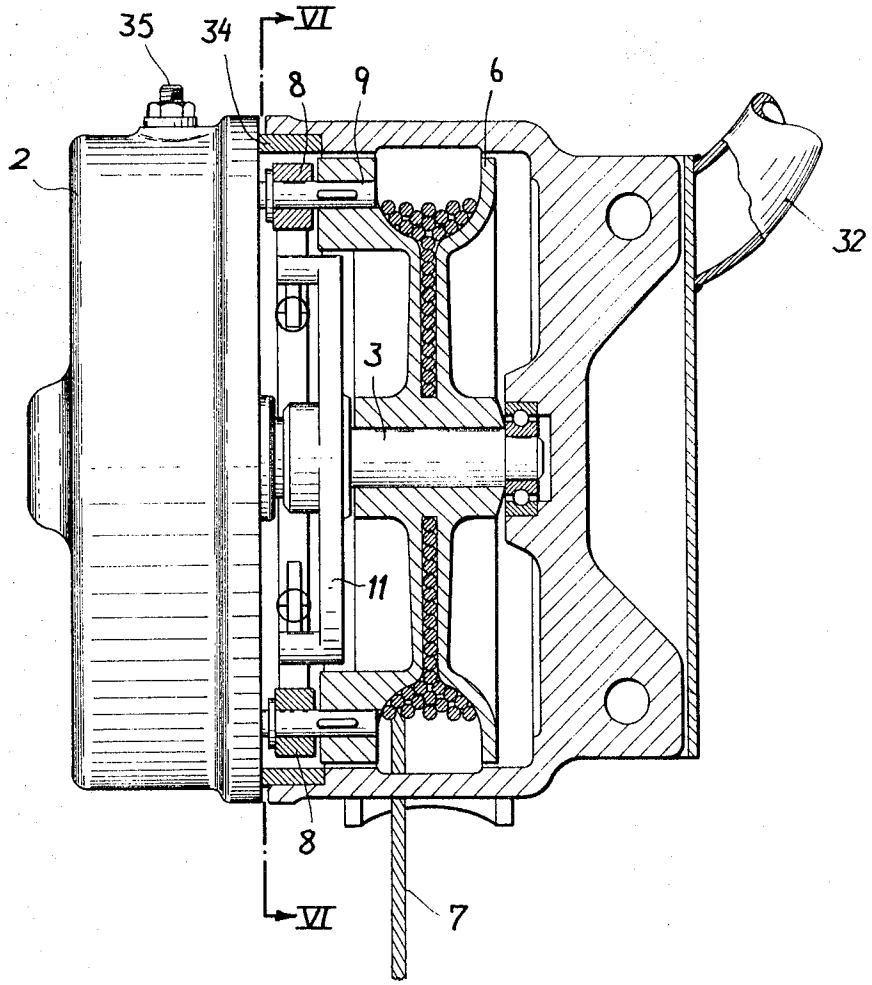


FIG. 5

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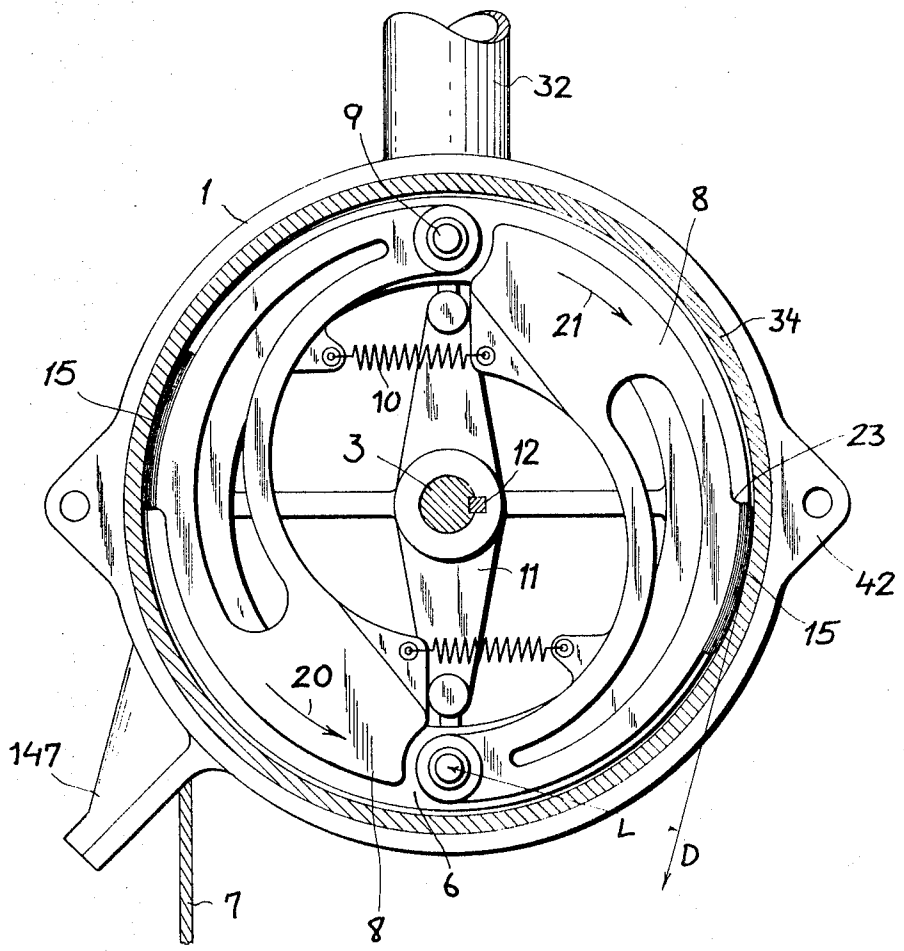


FIG. 6

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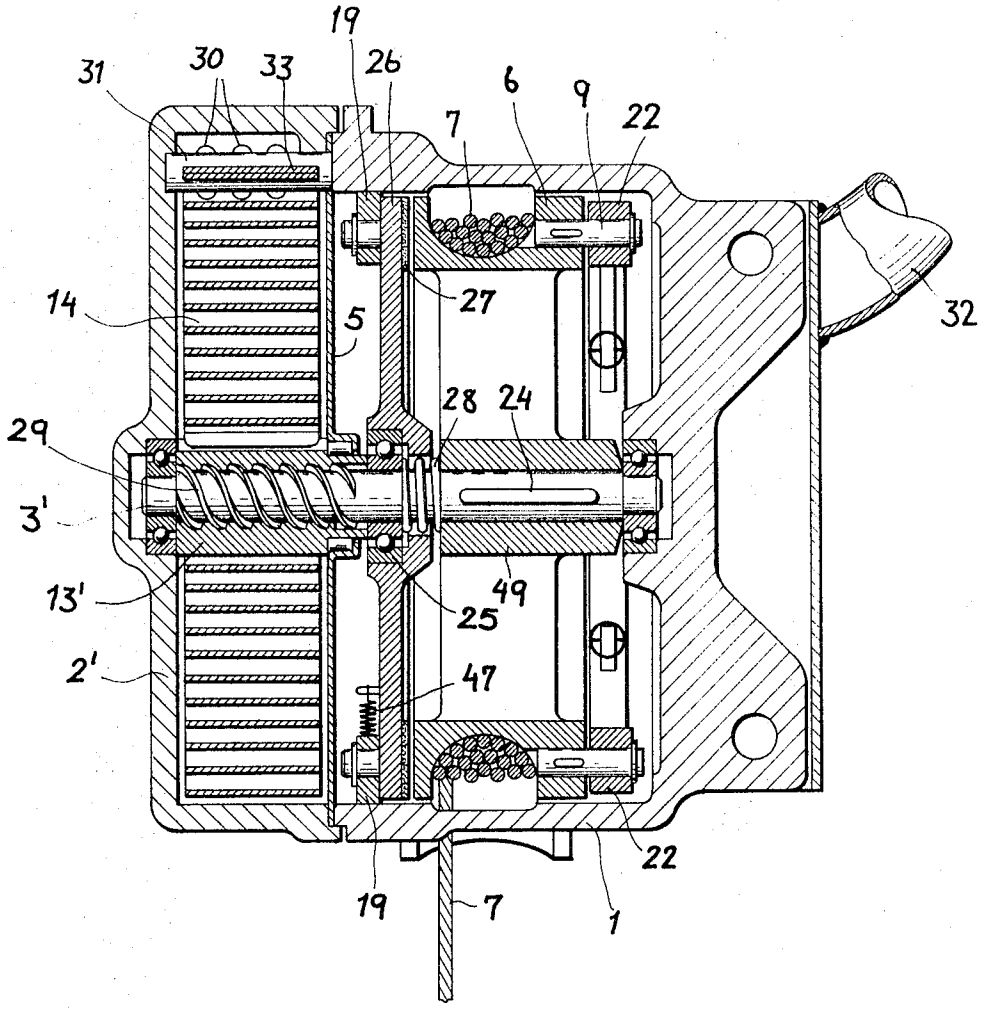


FIG. 7

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DRAGLINE WINCH FOR SKI TOWS AND THE LIKE

My present invention relates to a transportation system, such as a ski tow, in which a continuously moving conveyor has one or more attachments (e.g. tow bars or hooks intermittently engageable with loads to be accelerated thereby.

In order to damp the impact of entrainment upon the initial engagement of a towing attachment with the body of a skier, it is known in such systems to interpose a spring-loaded winch between the conveyor and the attachment, the winch having a reel from which a dragline anchored to the bar or hook unwinds against the spring force as the skier grabs the attachment or allows himself to be gripped thereby. The progressive increase in the restoring force of the spring (usually a flat spiral spring) gradually accelerates the skier until his speed equals that of the conveyor when the combined forces of gravity and friction are balanced by the spring force. After the skier disengages himself from the towing attachment, the spring rotates the reel in the opposite direction to rewind the dragline preparatorily to another loading operation; the windup speed at this time may be limited by a centrifugal brake in the winch housing.

Prior constructions of this type exhibit various disadvantages, including particularly a short service life for the spiral spring which tends to fatigue rapidly under the described conditions of use. Another drawback of conventional constructions is that a spring of this type, if soft enough to mitigate the initial impact to the desired degree, allows a considerable length of dragline to be payed out until an equilibrium of stress has been reached, with the result that successive towing attachments must be relatively widely spaced along the conveyor; this is true even where the reel is designed to have the dragline wound thereon in a multiplicity of layers of progressively increasing diameter so that the length of cable payed out per reel revolution progressively decreases during unwinding.

The general object of my invention is to provide means in a system of this type for avoiding the aforestated inconveniences without unduly encumbering the construction of the winch.

A more specific object of my present invention is to provide a winch for the purpose described whose restoring spring is progressively relieved during the unwinding of its dragline so that at least a substantial share of the loading force is ultimately transmitted directly to the winch housing, thereby increasing the useful life of the spring.

These objects are realized, pursuant to my invention, by the provision of a normally inoperative brake mechanism between the reel and the housing for progressively slowing and eventually arresting the paying-out of the dragline, the brake mechanism being actuatable by a coupling between the restoring spring and the reel upon a rotation of the latter in the direction of unwinding by the exertion of tension on the dragline.

In accordance with a more specific feature of my invention, the brake mechanism is predominantly effective in the unwinding direction of the reel, its effectiveness in the opposite direction being either negligible or considerably reduced. In the first instance it will be desirable to equip the winch with a supplemental brake of the centrifugal type for limiting the reel speed during rewinding in a manner known per se; in the second case the reduced countertorque exerted by the unsymmetrically effective brake mechanism eliminates the need for this supplemental brake.

Advantageously, the brake mechanism is normally biased in its inoperative position by one or more springs of sufficient force to restrain the coupler from actuating the brake until the restoring spiral spring has been tightened by one or more rotations of its movable (usually inner) end about the reel axis. Thereafter, the coupler is free to yield to the relative torque developed between the reel and the spiral spring to displace the operating member or members of the brake mechanism toward a coacting surface. This displacement may occur radially or axially; thus, I may provide a pair of outwardly swingable brakeshoes on one of the reel faces, or I may design this reel face itself as part of the brake by letting the reel move axially toward a confronting disc or vice versa. If brakeshoes are used, the coupler may comprise a pair of spreader arms rotatable about the reel axis and positioned for engagement with these shoes at respective points which, preferably, are offset from the fulcra of the brakeshoes in the direction of unwinding rotation; in such an arrangement, the contact pressure exerted by these shoes upon a surrounding drum depends upon the location of a brake lining on each shoe and increases as a result of additional leverage acting upon the brakeshoe in response to frictional engagement between the lining and the drum surface. In fact, by moving the brake lining to a location approximately 90° forwardly of the fulcrum (as viewed in the direction of windup) I can exert sufficient leverage to make the brake predominantly effective in the unwinding direction, with corresponding reduction of its effectiveness in the opposite direction, while making the drum rigid with the winch housing; in other instances this unsymmetrical effectiveness may be obtained by rotatably disposing the drum inside the housing and coupling it to the latter through unidirectional detent means of the pawl-and-ratchet or overrunning-clutch type.

The invention will be described in greater detail hereinafter with reference to the accompanying drawing in which:

FIG. 1 is an axial sectional view of a winch according to the invention, interposed between a conveyor and a tow bar;

FIGS. 2 and 3 are cross-sectional views respectively taken on the lines II–II and III–III of FIG. 1;

FIG. 4 is a cross-sectional view similar to FIG. 3, showing a modification;

FIG. 5 is an axial view similar to FIG. 1, illustrating another embodiment;

FIG. 6 is a cross-sectional view similar to FIG. 2, taken on the line VI–VI of FIG. 5; and

FIG. 7 is another axial view similar to FIG. 1, illustrating a further embodiment.

The system shown in FIGS. 1—3 comprises a winch 40 having a housing 1 rigidly secured to a carrying arm 32 which is part of a continuously movable conveyor, not further illustrated, of the type used in ski tows and similar transportation systems. A towing attachment 41 (shown as a T-bar) is secured to an end of a cable or dragline 7 wound upon a reel 6 which is freely rotatable on a shift 3 coaxially journaled, by means of bearings 4, within the cylindrical housing 1 and an adjoining end cap 2. Although the reel 6 could have a variety of configurations (cylindrical, tapered, V-pulley and so forth), I have illustrated it as a grooved pulley in which the cable 7 is constrained to form turns of increasing radius on being wound up; the end of the cable remote from tow bar 41 is fastened to the reel 6 near the bottom of its peripheral groove.

Housing 1 has a pair of lateral flanges 42 (FIGS, 2 and 3) bolted to similar flanges, not shown, of end cap 2 which accommodates a spiral leaf spring 14. The inner end of this leaf spring is fixed to a hub 13 which is positively coupled with shaft 3 by means of a key 12. Several outer layers of the spring 14 are secured to the inner wall of cap 2 by a bolt 35. Spring 14 is isolated from the interior of housing 1 by a transverse partition 5 forming a further journal 4*a* for the hub 13.

Reel 6 is provided, at two diametrically opposite locations, with a pair of pivot pins 9 projecting toward partition 5 and with another pair of similar pins 9*a* extending in the opposite axial direction. Pins 9 form the fulcra of a pair of arcuate levers 8 carrying respective brake linings 15 near the inner peripheral surface of a drum 16 which is rotatably supported, through the intermediary of a ball bearing 17, on a hub 43 of a spreader engaged by the key 12, this spreader having a pair of arms 11 whose extremities bear upon lugs 44 of the brakeshoe-forming levers 8. Two biasing springs 10 interconnect the lug 44 of one lever and a confronting lug 45 on the opposite lever, thereby normally drawing these levers toward each other so as to lift the brake linings 15 off the surface of drum 16. This drum also carries a pair of diametrically op-

posite pins 46 each having a cam-shaped wedge piece 19 swingably mounted thereon; these wedge pieces, biased toward the inner surface of housing 1 by respective springs 47, serve as unidirectionally effective detents which prevent a counterclockwise rotation (arrow 20, FIGS. 2 and 3) of drum 16 relative to housing 1.

With the cable 7 emerging from an outlet 147 at the left-hand side of the housing as viewed in FIGS. 2 and 3, a skier gripping the tow bar 41 tensions the cable in the direction of arrow A and turns the reel in the direction of arrow 20 so that the pair of abutments constituted by lugs 44 bear upon the arms 11 and rotate the spreader 11, 43 in the same sense, with consequent entrainment of shaft 3 and spring hub 13. This rotation is resisted by the contracting turns of spring 14, yet the countervailing restoring force of that spring is initially insufficient to move the brakeshoes 8 apart against the force of their biasing springs 10. After a few rotations of shaft 3, however, this biasing force is overcome and the brake linings 15 are urged with ever-increasing force against the inner surface of drum 16. Owing to the overrunning-clutch effect of wedges 19, whose surfaces may be suitably roughened along with the cooperating housing surface, rotation of drum 16 in this direction relative to housing 1 is blocked so that the frictional contact between brake linings 15 and drum 16 slows down and eventually stops the unwinding of the cable 7 from the reel 6. The progressively increasing spring force results in a similar gradual rise of the contact pressure of the brake linings so that the skier holding the tow bar 41 is smoothly accelerated; once the brake mechanism 8, 11, 16, 19 has become fully effective, the pull of the cable is transmitted directly to winch housing 1 without further stressing the spring 14.

When the skier releases the tow bar 41, spring 14 is free to turn the reel 6 in the clockwise direction (arrow 21, FIGS. 2 and 3) to rewind the cable 7 on the reel; the free mobility of drum 16 in this windup direction prevents jamming and readily allows the springs 10 to disengage the levers 8 from the inner drum surface. In order to limit the rotary clockwise speed of reel 6 (as viewed in FIGS. 2 and 3) during this windup, the pins 9*a* of the reel carry a pair of levers 22 which, as illustrated in dotted lines in FIG. 3, are generally similar to levers 8 but lack the brake linings 15 of the latter. The levers 22, serving as auxiliary brake means, are spread apart against the action of springs 10*a*, anchored to lugs 44*a* and 45*a*, by centrifugal force to slow down the windup of cable 6 in order to prevent the tow bar 6 from being flung across the moving conveyor band.

At the end of the rewinding operation, tow bar 41 or some other abutment on cable 7 arrests the reel 6. The tension of spring 14 in this normal position may be adjusted, upon a detachment of cap 2 from housing 1, by relatively rotating the cap and the housing before reinserting the mounting bolts through lugs 42. Advantageously, the spring 14 has a characteristic whose slope increases toward the end of the unwinding operation so as to make the brake mechanism fully effective at a predetermined point. The initial towing force may be as low as 3 kp, rising gradually to a value of about 90 kp required for the entrainment of the average skier.

In a modification illustrated in FIG. 4, the wedge pieces 19 have been replaced by pawls 18 engaging ratched teeth 48 on the inner periphery of housing 1.

FIGS. 5 and 6 illustrate an embodiment wherein the centrifugal brake members 22 have been omitted and the drum 16 has been replaced by a drum 34 rigid with housing 1. The lining 15 of each brakeshoe has been relocated to a position further away from the corresponding fulcrum 9, i.e. into the vicinity of a shoulder 23 spaced 90° from that fulcrum in the counterclockwise direction, so that the frictional drag D acting tangentially upon the lining during unwinding (rotation in the direction of arrow 20) exerts an appreciable supplemental torque upon the brakeshoe, owing to the large lever arm L, to increase the contact pressure which resists rotation of the reel 6 in that direction. This supplemental torque disappears when the rotation of the reel is reversed, yet the centrifugal force and the residual stress of leaf spring 14 suffice to generate enough friction for preventing overly rapid rewinding. For this purpose the springs 10 should be somewhat weaker than in the embodiment of FIGS. 1—3, preferably so that their biasing force is overcome virtually as soon as the user grips the tow bar 41 to tension the cable 7.

In FIG. 7 I have shown a further variant wherein reel 6 is decelerated by axial rather than radial displacement of a brake member, specifically a disc 26 confronting a face of reel 6 and carrying brake linings 27. Disc 26 is equipped with the same unidirectional detents (here wedges 19) as drum 16 in the embodiment of FIGS. 1—3; naturally, these detents could also be replaced by the pawls 18 of FIG. 4.

Shaft 3′ of FIG. 7 has a threaded portion 29 mating with internal threads on the hub 13′ of spiral spring 14, the pitch of the threads 29 being so chosen that hub 13′ advances toward the hub 49 of reel 6, which is secured to shift 3′ by a key 24, whenever the spring 14 is stressed by an unwinding rotation of the reel. Disc 26 is freely supported on shaft 3′ by a ball bearing 25 which is under axial pressure from a biasing spring 28 expanding against the fixed reel hub 49. Bearing 25 is also in contact with hub 3′ so that disc 26 is driven toward the confronting face of reel 6 whenever the two hubs 13′ and 49 move toward each other under the circumstances just referred to. It will be apparent that the same effect can be had by immobilizing the hub 13′ with reference to shaft 3′ and providing a threaded engagement between this shaft and the hub 49.

FIG. 7 also shows an alternate anchorage of the outer end of spring 14 to housing cap 2′, this cap being provided near its periphery with a swivel pin 31 extending parallel to the shaft 3′. Rivets 30 serve to fasten the terminal portion 33 of the leaf spring 14 in a slot of the pin 31 so that this terminal portion may swing more freely as the spring turns contract, thereby preventing the formation of kinks which would weaken the spring. The arrangement is otherwise similar to that of FIG. 1, with provision of auxiliary brake means 22 to limit the unwinding speed of the reel.

It will be apparent that the arrangement described and illustrated can be utilized in conjunction separate transportation systems other than ski tows and that details thereof may be modified in various ways without departing from the spirit and scope of my invention as defined in the appended claims.

I claim:

1. In a transportation system having a continuously movable conveyor, a spring-loaded winch on said conveyor, a dragline secured to said winch and an attachment anchored to said dragline for intermittent entrainment of a load, the improvement wherein said winch comprises:

a generally cylindrical housing;

a reel rotatably journaled in said housing with said dragline anchored thereto for rotation about an axis upon unwinding of the dragline;

a spiral spring having an end secured to said housing;

coupling means linking the other end of said spring with said reel for resisting unwinding of said dragline under load and for reversing the rotation of the reel upon detachment of the dragline from a load;

brake means movably mounted on said reel for engagement with a surrounding surface; and

biasing means engaging said brake means for urging same inwardly, said coupling means including a formation bearing upon said brake means for moving same into rotation-impeding contact with said surface, against the force of said biasing means, upon a stressing of said spring by the unwinding of the dragline under the action of an entrained load.

2. The improvement defined in claim 1 wherein the force of said biasing means is sufficient to balance the force of said spiral spring for several revolutions of said reel upon incipient unwinding.

3. The improvement defined in claim 1 wherein said brake means comprises a pair of brakeshoes pivotally mounted on said reel at diametrically opposite fulcra offset from said axis,

said coupling means including a spreader mounted for coaxial rotation with said reel in said housing and provided with a pair of arms constituting said formation.

4. The improvement defined in claim 3 wherein said winch comprises a shaft positively coupled with said spreader and anchored to said other end of said spring, said reel being freely rotatable on said shaft.

5. The improvement defined in claim 4 wherein said surface is part of a drum freely rotatable on said shaft, said drum and said housing being provided with coacting unidirectional detent means preventing rotation of said drum relative to said housing in the direction of unwinding, said reel being provided with a centrifugal brake independent of said brake means effective to limit the speed of rotation of the reel in the lowermost direction.

6. The improvement defined in claim 3 wherein said brakeshoes are formed with a pair of diametrically opposite abutments and have fulcra offset in the direction of windup from said abutments, said drum-engaging portion being a pair of brake linings positioned on said brakeshoes between said fulcra and said abutments.

7. The improvement defined in claim 6 wherein said drum is rigid with said housing, said brake linings being offset from the respective fulcra by approximately 90° for exerting additional leverage upon said brakeshoes during rotation of said reel in the unwinding direction.