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C. J. BARECKI

2,760,737

INERTIA LOCKING SAFETY REEL

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3 Sheets-Sheet 1

Fig. 1

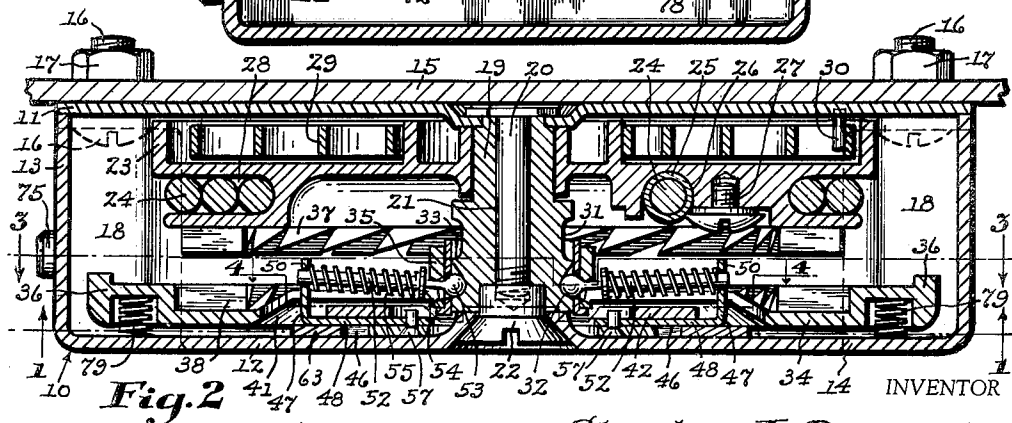
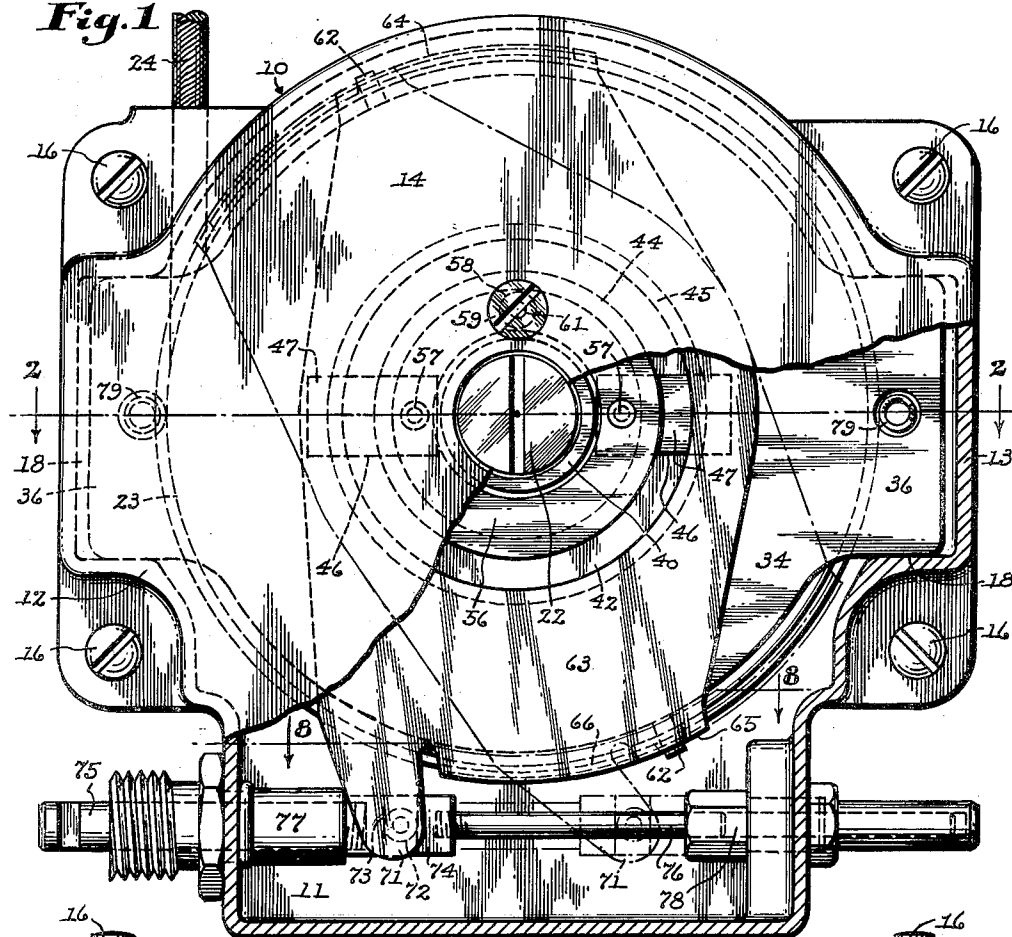


Fig. 2

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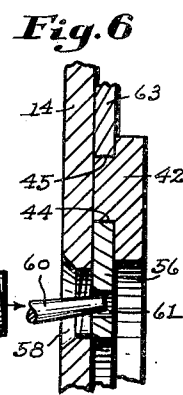
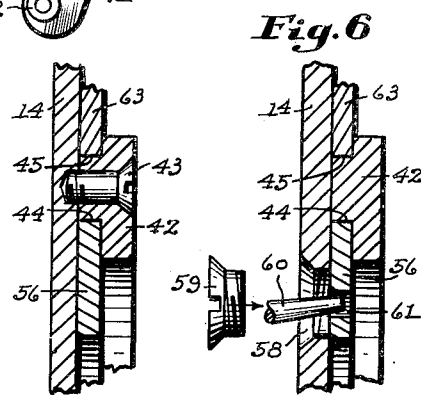
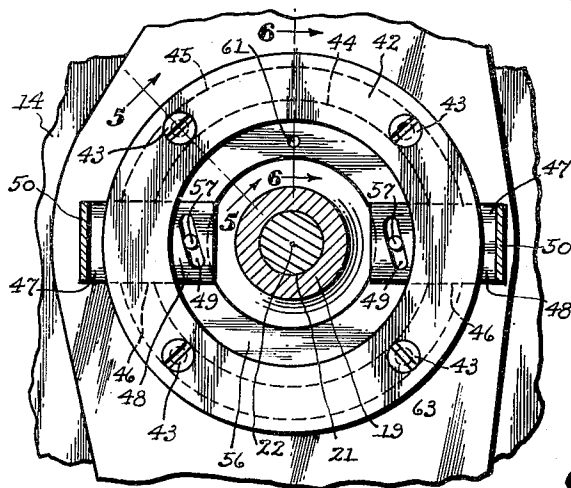
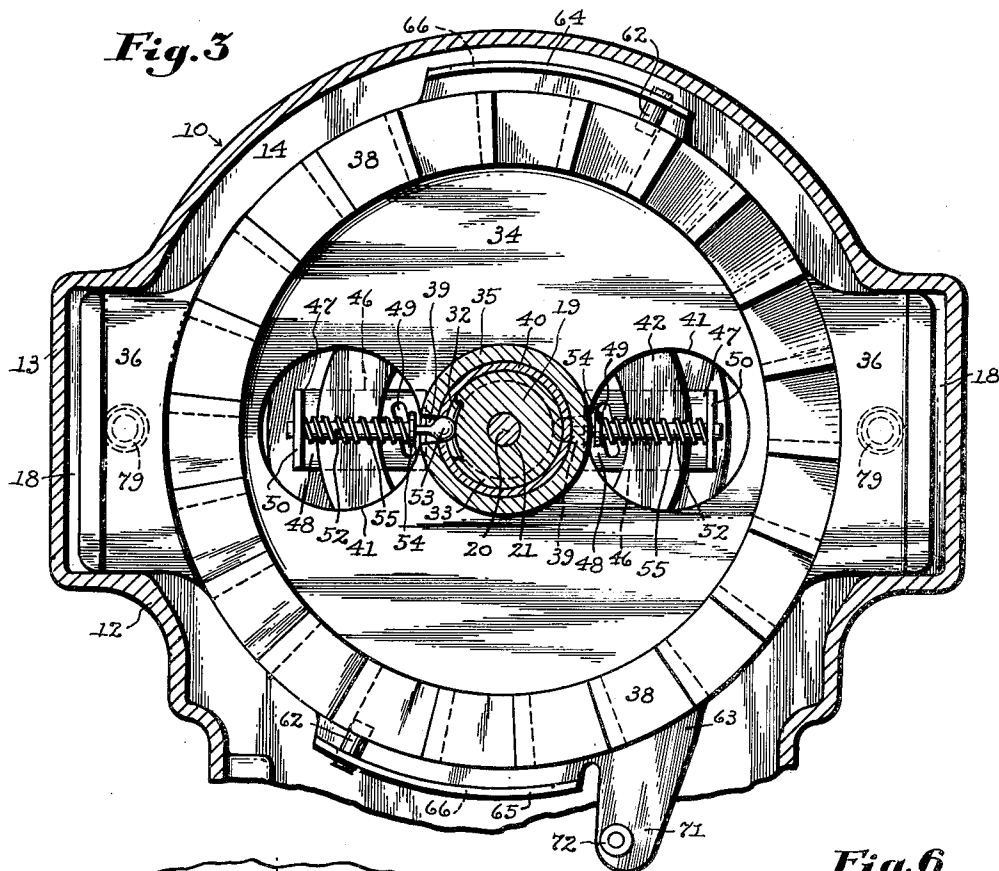
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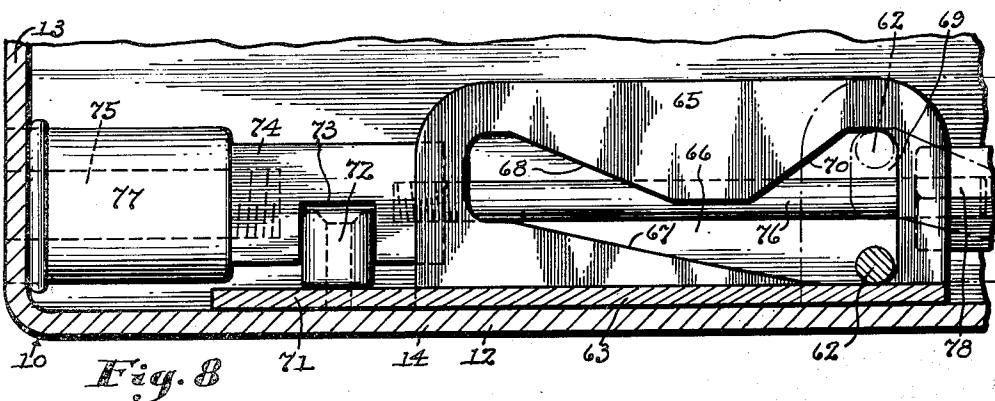
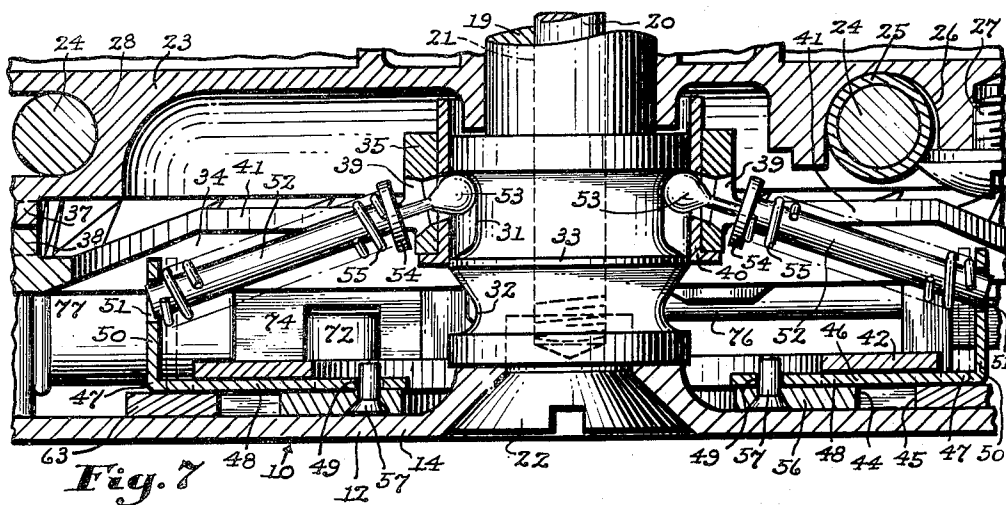
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INERTIA LOCKING SAFETY REEL

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3 Sheets-Sheet 3



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INERTIA LOCKING SAFETY REEL

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Application September 20, 1955, Serial No. 535,372

10 Claims. (Cl. 242—107)

The present invention relates to inertia locking safety reels for attachment to shoulder harnesses for the occupants of airplanes or other vehicles.

This invention is in the nature of an improvement of the Safety Reel and Spring Assembly Therefor disclosed in Patent No. 2,706,603 issued April 19, 1955, in the name of Joseph A. Miller and by him assigned to my assignee. The primary objects of the present invention are to provide an inertia-locking safety shoulder harness reel having improved mechanism whereby the G-force at which the reel becomes inertia-locked can be more accurately controlled and regulated; to provide such a reel which becomes more positively locked and also more positively unlocked than previous reels; and to provide such a reel which is improved in other respects hereinafter appearing.

An illustrative embodiment of the invention is shown in the accompanying drawings, wherein:

Figure 1 is a rear elevational view of the new reel with a portion of the housing broken away to reveal internal parts beyond the section line 1—1 of Figure 2, looking forwardly;

Figure 2 is a horizontal sectional view thereof taken on line 2—2 of Figure 1;

Figure 3 is a fragmentary vertical sectional view taken on line 3—3 of Figure 2, looking rearwardly;

Figure 4 is a fragmentary vertical sectional view of parts of the reel taken on line 4—4 of Figure 2, also looking rearwardly;

Figure 5 is an enlarged, fragmentary sectional view of parts of the reel taken on line 5—5 of Figure 4;

Figure 6 is an enlarged, fragmentary sectional view of parts of the reel taken on line 6—6 of Figure 4;

Figure 7 is a greatly enlarged fragmentary horizontal sectional view of parts shown in Figure 2, but with some of the parts being shown in different moved positions; and

Figure 8 is a greatly enlarged fragmentary sectional view of parts of the reel taken on line 8—8 of Figure 1.

Referring now in detail to these drawings, the reel is enclosed in a housing 10 which comprises a base or front plate 11 and a casing 12, the latter part forming the side wall 13 and rear wall 14 of the housing. The housing 10 is adapted for mounting in an upright position on the rear surface of a vehicle chair back, shown fragmentarily at 15 in Figure 2, by means of bolts 16 having nuts 17. The casing 12 is formed at its opposite sides to provide internal keyways or guides 18 which extend forwardly-rearwardly.

A spindle 19 is mounted in the housing 10 and extends forwardly-rearwardly therein midway between the housing's guides 18, in the approximate center of the housing. The spindle 19 is secured in fixed position by means of a screw 20 which extends rearwardly through the front plate 11 of the housing, through a central bore 21 in the spindle 19 and is threaded into a nut 22 countersunk into the rear wall 14 of the casing 12. The screw 20 and nut

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22 also secure the housing's front plate 11 and casing 12 together.

A cable drum 23 is rotatably and non-slidably mounted on the reduced forward end of the spindle 19, and is adapted to receive a cable 24 wound thereon. The inner end of the cable 24 has a fitting 25 which is secured in a cavity 26 cast in the drum 23, by means of a set screw 27 (see Figures 2 and 7). The cable may be wound into the drum's outer groove 28 by turning the drum counter-clockwise as viewed in Figure 1, and the drum is normally urged in such turning direction for taking up the cable by means of a spiral spring 29 having its inner end connected to the drum and its outer end connected to a pin 30 set into the front plate 11 of the housing (see Figure 2). The other or outer end of the cable 24 passes upwardly out of the housing 10 and is connected to the chair occupant's shoulder harness (not shown).

The spindle 19 has in its rearward portion a pair of circumferential recesses, the forward recess 31 being relatively wide and the rearward recess 32 being relatively narrow. These recesses 31, 32 are separated by a circumferential ridge 33. The forward recess 31 merges into the ridge 33 at a relatively sharp angle, whereas the rearward recess 32 merges into the ridge 33 at a relatively wide angle. The functions of these recesses and the ridge will hereinafter be made apparent.

A locking member 34 has a central boss 35 by which it is forwardly-rearwardly slidably mounted on the spindle 19 rearwardly of the drum 23, and the locking member has key means—the side wings 36—which are forwardly-rearwardly movable in the housing's guides 18 thus keying the locking member 34 against rotation. Cooperative locking means are provided on the rearward part of the drum and on the forward part of the locking member which are adapted to engage when the locking member is slid forwardly into engagement with the drum thus to lock the drum against rotation in the direction for paying out the cable. As here shown, these cooperative locking means comprise a ring of ratchet teeth 37 on the rear surface of the drum 23 and a complementary ring of ratchet teeth 38 on the front surface of the locking member 34.

The central boss 35 of the locking member has diametrically opposite apertures 39 therethrough (see Figure 7) which communicate with the recessed and ridged rearward portion of the spindle 19. If desired, the boss 35 may be provided with a long-wearing, self-lubricating bushing 40, and when such a bushing 40 is provided as shown the apertures 39 through the boss also extend through the bushing. The locking member 34 has diametrically opposite circular voids 41 therethrough, which communicate with the apertures 39 in the boss.

An annular bearing ring 42, of generally cross-sectionally T-shaped form, circumscribes the rearward end of the spindle 19 and is secured to the rear wall 14 of the housing by means of screws 43. The bearing ring 42 has a circular internal bearing 44, a circular external bearing 45, and a pair of diametrically opposite, laterally extending slide bearings 46 in registry with the voids 41 in the locking member.

A pair of angle brackets 47 each has an inner arm 48 laterally slidably disposed in one of the bearing ring's slide bearings 46 and each inner arm 48 has a cam slot 49 therethrough near its inner end as best seen in Figure 4. Each bracket 47 has also an outer arm 50 which extends forwardly from the outer end of the inner arm 48 through one of the voids 41 in the locking member 34 when the locking member is in a rearward position as seen in Figure 2. Each outer arm 50 has an aperture therethrough near its forward end which serves as a socket 51.

A pair of pins 52 have their outer ends turnably seated

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in the sockets 51 of the angle brackets' outer arms 50, and these pins 52 extend inwardly through the locking member's voids 41 and through the apertures 39 in the locking member's boss 35. The pins 52 have spherically formed inner heads 53 which bear against the recess and ridge portion of the spindle 19, and the pins have collars 54 thereon near their spherically formed heads (see Figures 3 and 7). Compression springs 55 circumscribe the pins 52, bearing against the pins' collars 54 and against the outer arms 50 of angle brackets 47. These springs 55 urge the pins inwardly so that the pins' inner heads constantly bear against the spindle's rearward portion. The springs 55 also urge the pins forwardly when the latter's heads are in the spindle's forward recess 31 and rearwardly when the pins' heads are in the spindle's rearward recess 32.

A cam ring 56 is turnably disposed in the circular internal bearing 44 of the bearing ring 42 and is provided with studs 57 which extend forwardly into the cam slots 49 of the angle brackets' inner arms 48. It will be seen that turning of the cam ring 56 moves the angle brackets 47 inwardly or outwardly thus to adjust the force exerted by the compression springs 55 on the pins 52. Provision is made for effecting such adjustments from the exterior of the housing so that the reel can be adjusted after it has been completely assembled. As best seen in Figures 1, 4 and 6 a threaded opening 58 is provided in the rear wall 14 of the housing, the opening being normally sealed with a countersunk screw 59. When it is desired to adjust the reel, the screw 59 is removed and a pointed tool, indicated fragmentarily at 60 in Figure 6, is inserted through the opening 58 and into a smaller opening 61 in the cam ring 56 and by this means the cam ring can be turned.

Means are provided for manually locking and unlocking the reel from the exterior of the housing. These means comprise diametrically opposite pins or lugs 62 on the outer periphery of the locking member 34 and a control plate 63 turnably mounted on the circular external bearing 45 of the bearing ring 42. The control plate 63 extends beyond the locking member in the regions of the latter's lugs 62 and has forwardly turned upper and lower flanges 64, 65 respectively provided with cam slots 66 which engage the lugs 62 to move the locking member 34 toward the drum 23 when the control plate 63 is turned counter-clockwise toward its position shown in full lines in Figure 1, and away from the drum 23 when the control plate 63 is turned in the opposite direction toward its position shown in broken lines in Figure 1. The lower flange 65 is seen in the unlocked position in full lines in Figure 8. When the control plate 63 is turned to move the lower flange 65 to the right in Figure 8 as seen in broken lines, the cam slot's edge 67 moves the lugs 62 and the locking member 34 forwardly to manually lock the reel. When the control plate 63 is oppositely turned, the cam slot's edge 68 manually unlocks the reel. When the reel is thus manually unlocked, it can become automatically inertia-locked due to the enlargement of the right hand end 69 of the cam slot 66 which permits the lug 62 to move forwardly in the slot. From such an inertia-locked position the reel can again be manually unlocked by turning the control plate 63 so that the lower flange 65 is moved first to the right and then to the left. During the movement to the right, the cam slot's edge 70 moves the lug 62 rearwardly toward its unlocked position a sufficient distance for the springs 55 to return lugs 62 and the locking member to their rearwardmost positions when the flange is moved to the left. The parts are then again in their manually unlocked positions seen in full lines in Figure 8.

The control plate 63 has a depending arm 71 provided with a roller 72 disposed in a cavity 73 in a block 74 into one end of which is threaded a rod 75 and into the other end of which is threaded a rod 76. These rods 75, 76 have bearings 77, 78 respectively in the opposite side walls of the housing, and the rod 75 is adapted for

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coupling to a control cable by means of which the manual locking and unlocking of the reel can be remotely controlled.

Operation

From the foregoing it will be seen that the chair occupant can manually lock his shoulder harness so that the cable 24 cannot pay out, although the drum is free to ratchet back to take up any slack in the cable. This voluntary manual locking of the reel so that the occupant cannot be thrown forward in the event of a crash, is sometimes desirable under conditions of take-off or landing. In normal flight, however, it is more desirable that the chair occupant—usually the vehicle's operator—have complete freedom of movement but nevertheless be protected in the event of a crash, by the reel's inertia-locking feature. With the reel unlocked, i. e. with the locking member 34 moved rearwardly away from the cable drum 23 as seen in Figures 1, 2 and 8, any sudden deceleration of the vehicle will throw the locking member 34 forwardly into ratchet engagement with the cable drum 23 thus to lock the reel. During this movement the locking member's central boss 35 carries the spherical inner ends 53 of pins 52 forwardly from the rearward recess 32 of spindle 19, over the spindle's ridge 33 and into the spindle's forward recess 31. The relatively wide angle at which the rearward recess 32 merges into the ridge 33 reduces the G-load at which the reel will lock by inertia. The recommended load for aircraft is usually about 2.5 G's. Manifestly the reel can be designed for greater or lesser inertia-locking forces by varying the angle at which the spindle's rearward recess 32 merges into the ridge 33. A greater force is required to move the pins 52 rearwardly over the relatively sharp angle at which the spindle's forward recess 31 merges into the ridge 33, thus insuring that the reel will remain inertia-locked in the event of subsequent crashes of the vehicle. Very fine adjustments of the forces required to operate the reel can be made by adjusting the compression of springs 55, as hereinbefore described. If desired, supplementary springs 79 may be included in the reel for augmenting springs 55 when the reel is locked. The force of any such springs 79 must also be considered in the design of the reel.

It will thus be seen that the invention provides an improved inertia-locking safety shoulder harness takeup reel which is positive in action and which can be accurately controlled and regulated, and while but one specific embodiment of the invention has been herein shown and described, it will be understood that numerous details may be altered or omitted without departing from the spirit of the invention as the same is defined by the following claims.

I claim:

1. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure; a spindle mounted in the housing and extending forwardly-rearwardly therein, said spindle having in its rearward portion a forward recess and a rearward recess separated by a ridge; a drum rotatably and non-slidably mounted on the spindle forwardly of said recesses and adapted to receive a cable wound thereon; a locking member having a central boss slidably and non-rotatably mounted on the spindle rearwardly of the drum, said boss having an aperture therethrough communicating with the recess and ridge portion of the spindle and said locking member having a void therethrough communicating with the aperture in the boss; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum; an arm extending forwardly from the housing's rear wall through the void in the locking member when the latter is in a rearward position, said arm being provided with a socket therein; a pin having its outer end turnably seated in said socket,

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said pin extending inwardly through the locking member's void and through the aperture in said member's boss and having its inner head end bearing against the recess and ridge portion of the spindle; and spring means urging said pin inwardly, said spring means also urging said pin forwardly when said pin's head is in the spindle's forward recess and rearwardly when said pin's head is in the spindle's rearward recess.

2. A reel device according to claim 1 characterized by said pin being one of a plurality of radially spaced pins identically mounted for bearing against the recess and ridge portion of the spindle.

3. A reel device according to claim 1 characterized by said pin being one of a pair of diametrically spaced pins identically mounted for bearing against the recess and ridge portion of the spindle.

4. A reel device according to claim 1 characterized by having the spindle's forward recess relatively wide and its rearward recess relatively narrow.

5. A reel device according to claim 4 characterized by having the spindle's forward recess merging into the ridge at a relatively sharp angle and rearward recess merging into the ridge at a relatively wide angle.

6. A reel device according to claim 1 characterized by having the inner head end of the pin of spherical formation.

7. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure; a spindle mounted in the housing and extending forwardly-rearwardly therein, said spindle having in its rearward portion a pair of circumferential recesses separated by a circumferential ridge; a drum rotatably and non-slidably mounted on the spindle forwardly of said recesses and adapted to receive a cable wound thereon; a locking member having a central boss slidably and non-rotatably mounted on the spindle rearwardly of the drum, said boss having diametrically opposite apertures therethrough communicating with the recess and ridge portion of the spindle and said locking member having diametrically opposite voids therethrough communicating with the apertures in the boss; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum; a pair of arms extending forwardly from the housing's rear wall through the voids in the locking member when the latter is in a rearward position, said arms being provided with sockets therein; a pair of pins having their outer ends turnably seated in said sockets, said pins extending inwardly through the locking member's voids and through the apertures in said member's boss, said pins having spherically formed inner heads bearing against the recess and ridge portion of the spindle and having collars thereon near their heads; compression springs circumscribing said pins and bearing against said collars and said arms for urging said pins inwardly, said springs also urging the pins forwardly when the pins' heads are in the spindle's forward recess and rearwardly when the pins' heads are in the spindle's rearward recess.

8. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure; a spindle mounted in the housing and extending forwardly-rearwardly therein, said spindle having in its rearward portion a pair of circumferential recesses separated by a circumferential ridge; a drum rotatably and non-slidably mounted on the spindle forwardly of said recesses and adapted to receive a cable wound thereon; a locking member having a central boss slidably and non-rotatably mounted on the spindle rearwardly of the drum, said boss having diametrically opposite apertures therethrough communicating with the recess and ridge portion of the spindle and said locking member having diametrically opposite voids therethrough

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communicating with the apertures in the boss; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum; a bearing ring secured to the rear wall of the housing and circumscribing the spindle's rearward end, said ring having a circular internal bearing and a pair of diametrically opposite laterally extending slide bearings in registry with the voids in said locking member; a pair of angle brackets each having an inner arm laterally slidably disposed in one of the bearing ring's slide bearings and provided with a cam slot therethrough, and each bracket having an outer arm extending forwardly from the outer end of the inner arm through one of the voids of the locking member when the latter is in a rearward position, said outer arms being provided with sockets therein; a pair of pins having their outer ends turnably seated in said sockets, said pins extending inwardly through the locking member's voids and through the apertures in said member's boss, said pins having spherically formed inner heads bearing against the recess and ridge portion of the spindle and having collars thereon near said heads; compression springs circumscribing said pins and bearing against said collars and the outer arms of the angle brackets for urging said pins inwardly, said springs also urging the pins forwardly when the pins' heads are in the spindle's forward recess and rearwardly when the pins' heads are in the spindle's rearward recess; a cam ring turnably disposed in the circular internal bearing of the bearing ring and provided with studs extending forwardly into the cam slots of the angle brackets' inner arms whereby turning of the cam ring moves the angle brackets inwardly or outwardly to adjust the force exerted by the compression springs on said pins.

9. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure; a spindle mounted in the housing and extending forwardly-rearwardly therein, said spindle having in its rearward portion a pair of circumferential recesses separated by a circumferential ridge; a drum rotatably and non-slidably mounted on the spindle forwardly of said recesses and adapted to receive a cable wound thereon; a locking member having a central boss slidably and non-rotatably mounted on the spindle rearwardly of the drum, said boss having diametrically opposite apertures therethrough communicating with the recess and ridge portion of the spindle and said locking member having diametrically opposite voids therethrough communicating with the apertures in the boss; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking member is slid forwardly into engagement with the drum; a bearing ring secured to the rear wall of the housing and circumscribing the spindle's rearward end, said ring having a circular internal bearing, a circular external bearing and a pair of diametrically opposite laterally extending slide bearings in registry with the voids in said locking member; a pair of angle brackets each having an inner arm laterally slidably disposed in one of the bearing ring's slide bearings and provided with a cam slot therethrough, and each bracket having an outer arm extending forwardly from the outer end of the inner arm through one of the voids of the locking member when the latter is in a rearward position, said outer arms being provided with sockets therein; a pair of pins having their outer ends turnably seated in said sockets, said pins extending inwardly through the locking member's voids and through the apertures in said member's boss, said pins having spherically formed inner heads bearing against the recess and ridge portion of the spindle and having collars thereon near said head; compression springs circumscribing said pins and bearing against said collars and the outer arms of the angle brackets for urging said pins inwardly, said springs also

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urging the pins forwardly when the pins' heads are in the forward recess and rearwardly when the pins' heads are in the spindle's rearward recess; a cam ring turnably disposed in the circular internal bearing of the bearing ring and provided with studs extending forwardly into the cam slots of the angle brackets' inner arms whereby turning of the cam ring moves the angle brackets inwardly or outwardly to adjust the force exerted by the compression springs on said pins; diametrically opposite lugs on the locking member; and a control plate turnably mounted on the circular external bearing of the bearing ring and having cam slots engaging said lugs whereby turning of the control plate moves the locking member forwardly or rearwardly on the spindle.

10. In a reel device of the class described: a housing adapted for mounting in an upright position on a suitable supporting structure, said housing having forwardly-rearwardly extending guides at the opposite interior sides thereof; a spindle mounted in the housing and extending forwardly-rearwardly therein midway between said guides, said spindle having in its rearward portion a pair of circumferential recesses separated by a circumferential ridge, the forward recess being relatively wide and merging into the ridge at a relatively sharp angle, and the rearward recess being relatively narrow and merging into the ridge at a relatively wide angle; a drum rotatably and non-slidably mounted on the spindle forwardly of said recesses and adapted to receive a cable wound thereon; a locking member having a central boss slidably mounted on the spindle rearwardly of the drum, said boss having diametrically opposite apertures therethrough communicating with the recess and ridge portion of the spindle and said locking member having diametrically opposite voids therethrough communicating with the apertures in the boss, said locking member also having key means at opposite sides thereof forwardly-rearwardly movable on the housing's guides whereby the locking member is keyed against rotation; cooperative locking means on the rearward part of the drum and on the forward part of the locking member adapted to engage when the locking

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member is slid forwardly into engagement with the drum; a bearing ring secured to the rear wall of the housing and circumscribing the spindle's rearward end, said ring having a circular internal bearing, a circular external bearing and a pair of diametrically opposite laterally extending slide bearings in registry with the voids in said locking member; a pair of angle brackets each having an inner arm laterally slidably disposed in one of the bearing ring's slide bearings and provided with a cam slot there-through, and each bracket having an outer arm extending forwardly from the outer end of the inner arm through one of the voids of the locking member when the latter is in a rearward position, said outer arms being provided with sockets therein; a pair of pins having their outer ends turnably seated in said sockets, said pins extending inwardly through the locking member's voids and through the apertures in said member's boss, said pins having spherically formed inner heads bearing against the recess and ridge portion of the spindle and having collars thereon near said heads; compression springs circumscribing said pins and bearing against said collars and the outer arms of the angle brackets for urging said pins inwardly, said springs also urging the pins forwardly when the pins' heads are in the spindle's forward recess and rearwardly when the pins' heads are in the spindle's rearward recess; a cam ring turnably disposed in the circular internal bearing of the bearing ring and provided with studs extending forwardly into the cam slots of the angle brackets' inner arms whereby turning of the cam ring moves the angle brackets inwardly or outwardly to adjust the force exerted by the compression springs on said pins; diametrically opposite lugs on the locking member; and a control plate turnably mounted on the circular external bearing of the bearing ring and having cam slots engaging said lugs whereby turning of the control plate moves the locking member forwardly or rearwardly on the spindle.

No references cited