March 28, 1961 L. E. HUSTED 2,976,959

RATCHET DEVICE

Filed April 29, 1957 4 Sheets-Sheet 1

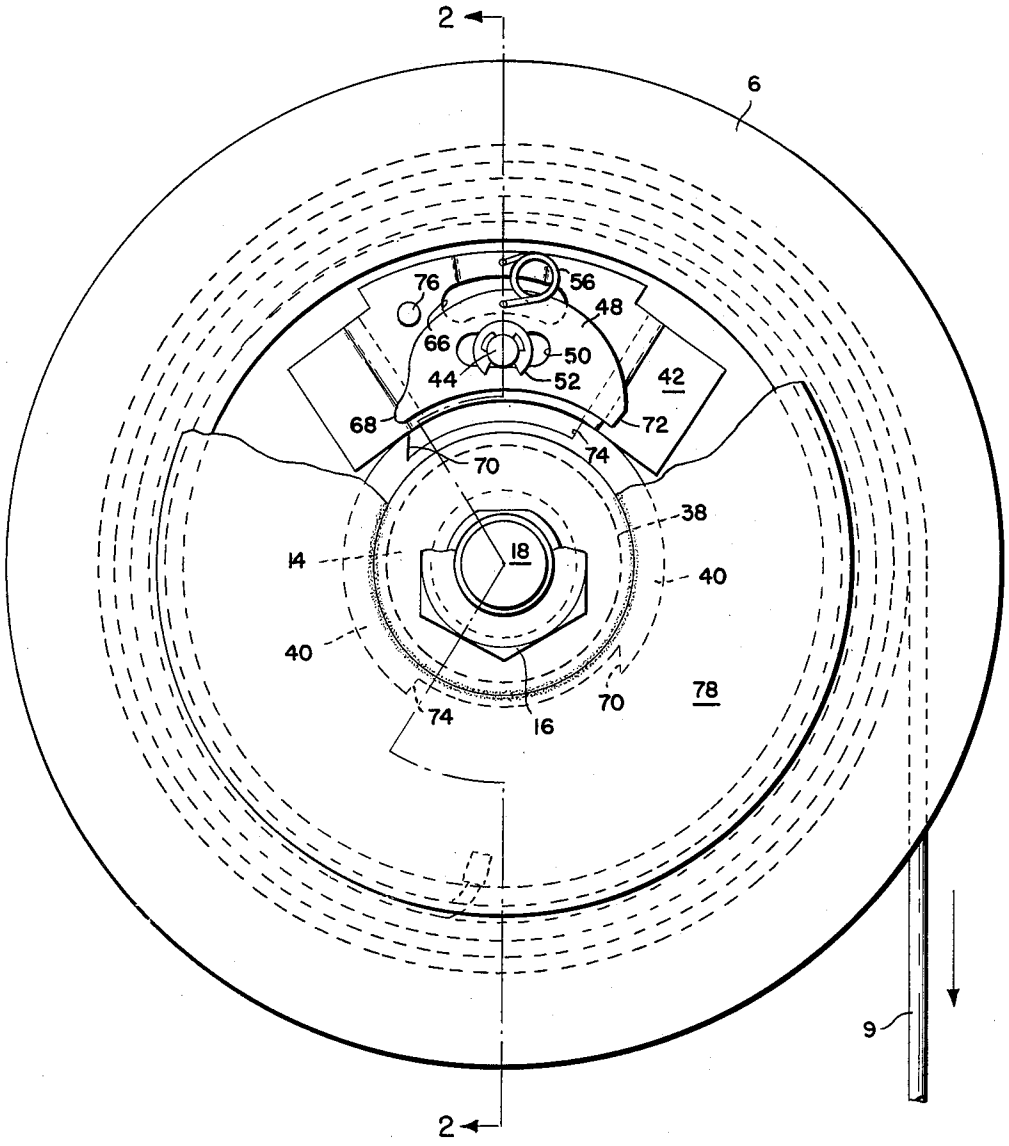


FIG. I.

INVENTOR.

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BY

Brown Smith & Hanley

ATTORNEYS

March 28, 1961 L. E. HUSTED 2,976,959

RATCHET DEVICE

Filed April 29, 1957 4 Sheets-Sheet 2

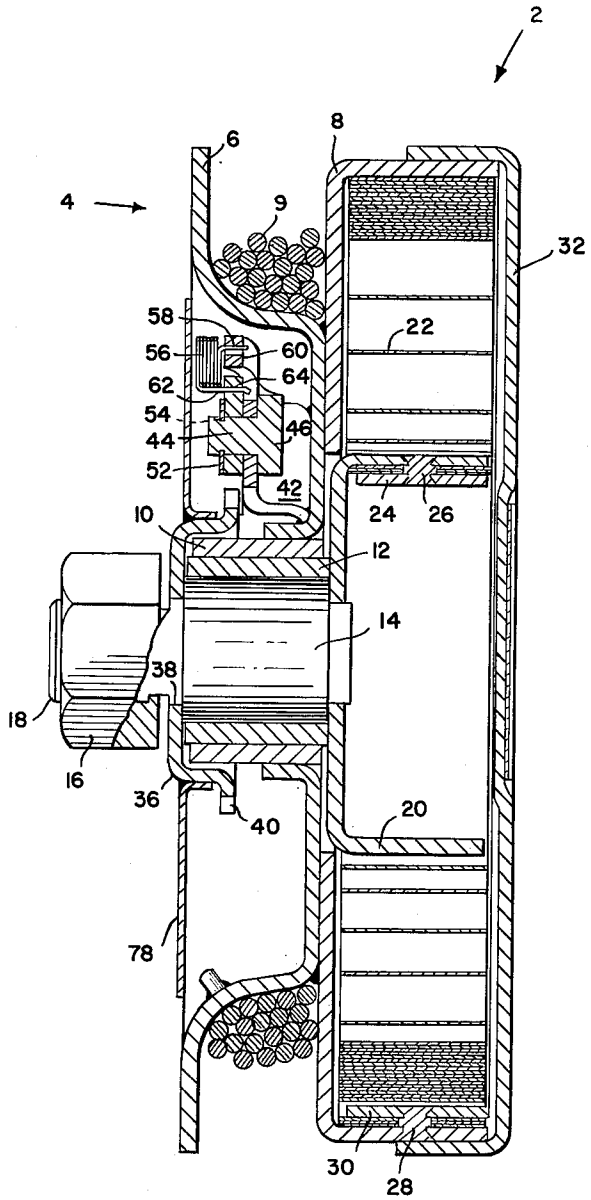


FIG. 2.

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RATCHET DEVICE

Filed April 29, 1957 4 Sheets-Sheet 3

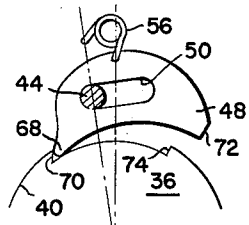


FIG. 3.

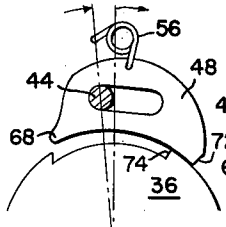


FIG. 4.

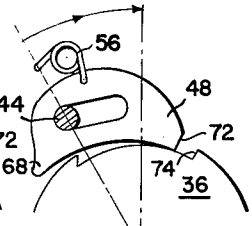


FIG. 5.

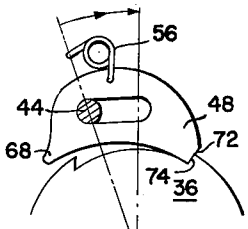


FIG. 6.

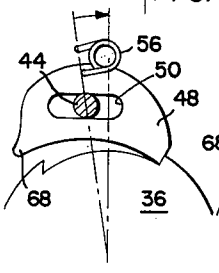


FIG. 7.

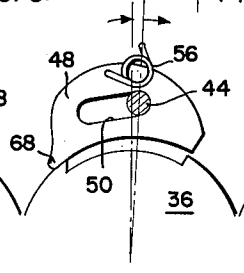


FIG. 8.

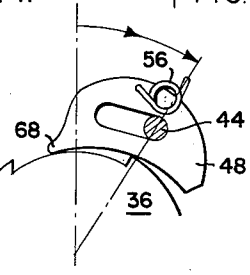


FIG. 9.

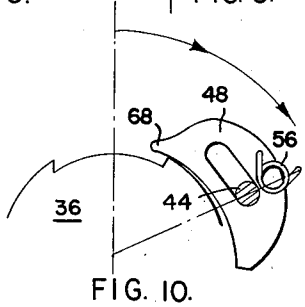


FIG. 10.

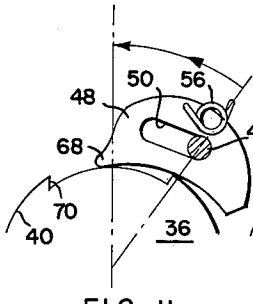


FIG. 11.

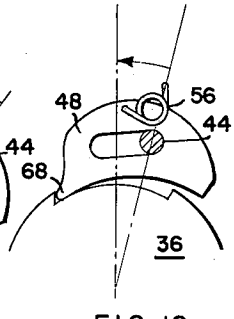


FIG. 12.

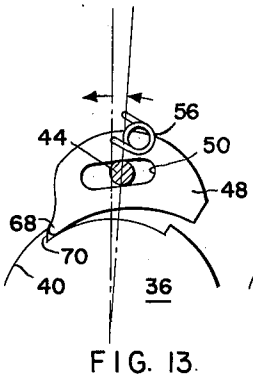


FIG. 13.

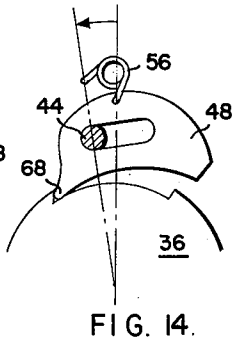


FIG. 14.

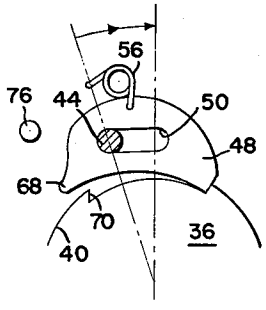


FIG. 15.

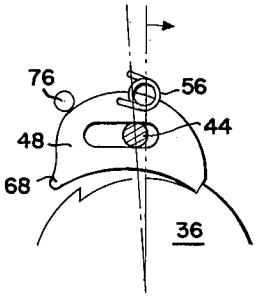


FIG. 16.

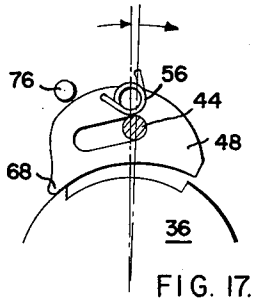


FIG. 17.

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Dixon Smith & Harding

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RATCHET DEVICE

Filed April 29, 1957 4 Sheets-Sheet 4

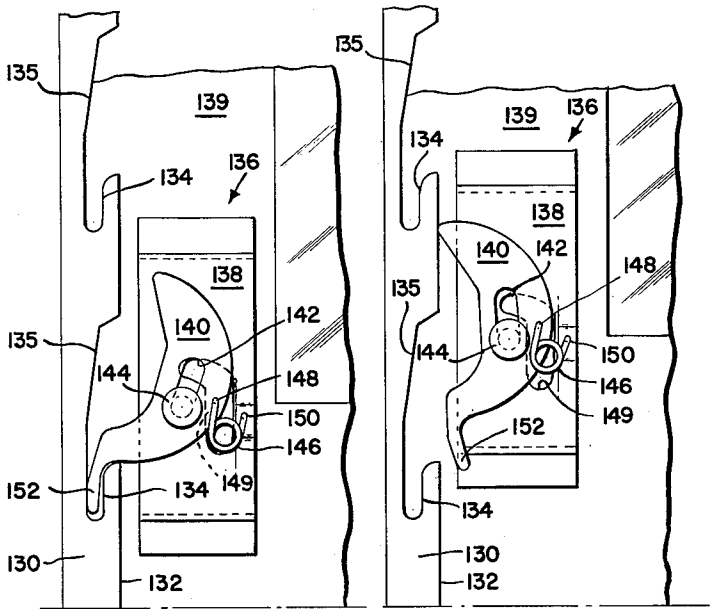


FIG. 20.

FIG. 21.

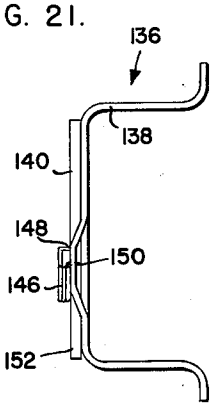


FIG. 22.

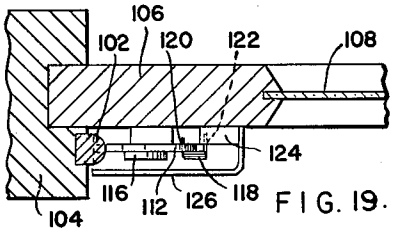


FIG. 19.

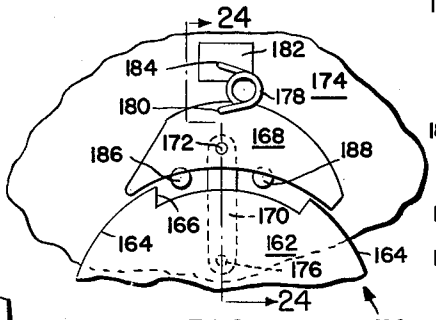


FIG. 23.

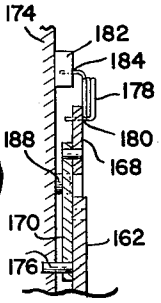


FIG. 24

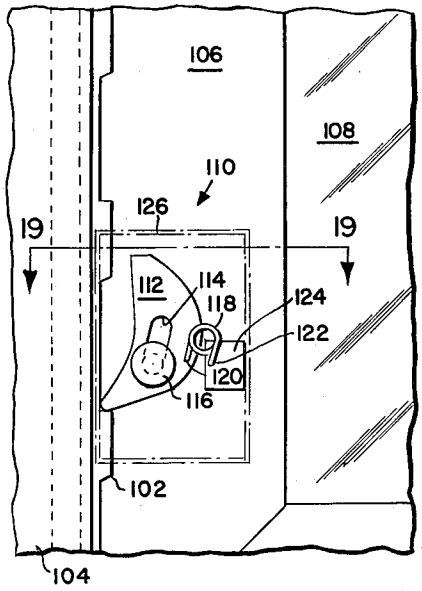


FIG. 18.

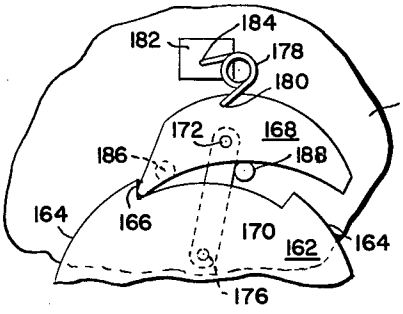


FIG. 25.

INVENTOR.

LAWRENCE E. HUSTED

BY

Brose Smith & Hardy

ATTORNEYS

United States Patent Office 2,976,959 Patented Mar. 28, 1961

2,976,959

RATCHET DEVICE

Lawrence E. Husted, Fairhill, Pa., assignor, by mesne assignments, to American Machine and Metals, Inc., New York, N.Y., a corporation of Delaware

Filed Apr. 29, 1957, Ser. No. 655,613

3 Claims. (Cl. 188—82.7)

This invention relates to a ratchet device. More particularly, it relates to such a device having a toothed ratchet member and a pawl on separate relatively movable members. Particular utility for the device of this invention is found in connection with a member which is biased to move in one direction and which is free to be moved in the opposite direction.

The ratchet device of this invention, for example, can be controlled to act as a stop preventing the movement of a member in the direction in which it is biased or, alternatively, to freely permit such movement, the action of the ratchet device being entirely controlled through the movement of the said member.

The device in accordance with this invention is highly advantageous due to the fact that it is very sensitive to control, avoids complex mechanisms and is inexpensive to fabricate.

Further, the device of this invention is highly advantageous due to the shortness of travel of a movement member required to effect the desired control.

The ratchet device of this invention can be employed with a wide variety of devices having relatively movable members of, for example, a rotary or linear nature.

The invention will be made clear by a study of the following description in conjunction with the drawings in which:

Figure 1 is a front elevation of a self-retracting reel embodying a ratchet device in accordance with this invention.

Figure 2 is a section taken on the planes indicated by the line 2—2 in Figure 1.

Figure 3 through 14 are schematic views showing the various relative positions of the pawl supporting the pin and ratchet wheel of the reel of Figure 1 in various steps of the operation of the reel.

Figures 15 through 17 are schematic views showing the relative positions of the pawl mounting pin, ratchet wheel and pawl camming pin of the reel of Figure 1 during the operation of the pawl camming pin.

Figure 18 is an elevation of the ratchet-pawl mechanism in accordance with this invention applied to a window sash and frame.

Figure 19 is a horizontal section taken on the plane indicated by the line 19—19 in Figure 18.

Figure 20 is an alternative ratchet-pawl mechanism adapted to be used with members having relative linear movement showing the mechanism in the locked position.

Figure 21 is a view of the ratchet-pawl mechanism of Figure 20 showing it in the unlocked position.

Figure 22 is a side elevation of the ratchet-pawl mechanism shown in Figure 20.

Figure 23 is a front elevation of an alternative ratchet-pawl mechanism in accordance with this invention.

Figure 24 is a section taken on the planes indicated by the line 24—24 in Figure 23.

Figure 25 is a front elevation of the ratchet-pawl mechanism of Figure 23 showing the mechanism in the locked position.

As shown in Figures 1 and 2, a self-retracting reel 2 is provided with a drum 4 formed from members 6 and 8 which are welded together. A cable 9 is shown partially coiled on drum 4.

Member 6 of drum 4 is brazed to a hub 10 which is secured by a pressed fit to a bearing 12 which rotates on arbor 14. Arbor 14 has a nut 16 which is threaded over threaded end 18 in order to secure arbor 14 fixedly to any desired supporting structure, arbor 14 thus being maintained against rotation during the operation of the reel.

The reel 2 is provided with a spring motor to provide for the automatic rewinding of cable 9. Any conventional motor can be employed such as, for example, a spiral type spring motor which is widely used in connection tion with self-retracting reels and which is illustrated in Figure 2. As shown in Figure 2, a drum 20 is brazed to arbor 14. A spiral spring 22 has its inner end secured to drum 20 by means of a plate 24 and rivet 26. The outer end of spring 22 is secured to member 8 by a rivet 28 and plate 30. A cover 32 is secured by a pressed fit on member 8 to provide a complete enclosure for spring 22.

The reel 2, as described above, is entirely conventional and is merely illustrative of a rotary structure in connection with which the ratchet-pawl device in accordance with this invention can be usefully employed. The novel aspects of the reel 2 embodying a device in accordance with this invention will now be described.

A ratchet wheel 36 is fixedly secured to arbor 14 at 38 and is provided with teeth 40. A bracket 42 is secured to member 6 and carries a pin 44 having an enlarged head 46. A pawl 48 lying in substantially the same plane as ratchet teeth 40 is provided with a slot 50 engaged by pin 44. Pawl 48 is maintained on pin 44 by a clip 52 secured in channel 54 in pin 44.

The center of pawl 48 is biased downwardly by a torsion spring 56. Spring 56 has an end 58 which passes through opening 60 in bracket 42 and its other end 62 passes through an opening 64 on the center line of pawl 48. It will, of course, be apparent that spring 56 is twisted prior to the insertion of the ends 58 and 62 into their respective openings so that the spring will, at all times, exert a substantial force. It will be evident from Figure 1 that, when pawl 48 is moved off center with respect to pin 44, spring 56 will act to pivot pawl 48 so that one end or the other of the pawl, depending upon the direction of the movement of pawl 48 off center, will be moved downwardly into engagement with the ratchet wheel 36. Similarly the spring will urge the appropriate end of the slot 50 against pin 44. Bracket 42 is provided with a slot 66 for the accommodation of end 62 of spring 56.

The trailing end of pawl 48 is provided with a nose 68 which is adapted to fit under the undercut portion 70 of teeth 40 which prevents the spring 56 from raising pawl 48 out of engagement with a tooth 40 when the ratchet-pawl mechanism is functioning to prevent rewinding of the reel as will be apparent from the subsequent description of the operation of the reel. The leading end of pawl 48 is provided with a squared face 72 to permit ready disengagement from the squared faces 74 of teeth 40.

Although not essential to the proper operation of the reel 2, there can be provided a pin 76 secured to bracket 42 and extending outwardly to a position where it can engage pawl 48. In the event of the weakening of spring 56 so that it is unable to disengage the leading end of pawl 48 from a ratchet tooth 40 during unreeling, the move-

ment of pin 76 will act to cam pawl 48 to effect the release of its leading end from a tooth 40.

The ratchet-pawl mechanism is protected by a cover plate 78 secured to ratchet wheel 36.

Operation

The operation of the ratchet-pawl mechanism of the reel 2 will be made readily apparent by consideration of the schematic showings in Figures 3 through 14 studied in conjunction with Figures 1 and 2. It should be pointed out that the pawl 48 would not normally be in the position shown in Figures 1 and 2 which was selected to facilitate a clear showing in the drawings. To place the reel 2 in operation, pawl 48 would first be manually shifted so that pin 44 was up against either end of slot 50. This, of course, is accomplished during the manufacturing of the reel prior to the securing of cover plate 78 in position.

Referring now particularly to Figures 3 through 14, the dscription will be facilitated by assuming the ratchet-pawl mechanism to be acting to prevent the reel from rewinding as shown in Figure 3. As seen in Figure 3, nose 68 is in engagement with undercut portion 70 of a tooth 40 and pin 44 is against the left-hand end of slot 50 as viewed in Figure 3. Spring 56 is attempting to pivot the leading end of pawl 48 downwardly so as to free nose 68 from tooth 40 but is prevented from doing so by the undercut portion 70 of tooth 40.

Bearing in mind that ratchet wheel 36 is fixed, that pin 44 is secured so as to move with drum 4 which contains cable 9 and that pawl 48 has a slot 50 permitting relative movement between pawl 48 and pin 44, if cable 9 is now pulled outwardly so as to unreel, which causes drum 4 to move clockwise as viewed in Figure 1, this will, in turn, (Figure 4) cause pin 44, spring 56 and pawl 48 to move clockwise as viewed in Figure 4 withdrawing the trailing end of pawl 48 from tooth 40 and permitting spring 56 to pivot the leading end of pawl 48 downwardly. As shown in Figures 5 and 6, further rotation in this direction causes face 72 on the leading end of pawl 48 to be forced into engagement with face 74 of the next tooth 40 which arrests the motion of pawl 48. Pin 44 continues to move clockwise as viewed in Figures 7 and 8 until it passes beyond the center line of pawl 48 permitting spring 56 to pivot pawl 48 so that the leading end is moved upwardly out of engagement with tooth 40, pin 44 moving to the end of slot 50.

As shown in Figures 9 and 10, as the cable 9 continues to be unreeled, the trailing end of pawl 48 follows the contour of ratchet wheel 36 while the leading end is maintained clear of the ratchet wheel to permit the free unwinding of cable 9.

It is now desired to stop unreeling cable 9 and yet retain substantially the same amount of cable unreeled. The spring motor is permitted to reel in a short length of cable 9 moving drum 4 counterclockwise as viewed in Figure 1. In turn, as shown in Figure 11, pawl 48 and pin 44 are moved counterclockwise with spring 56 continuing to force the nose 68 of pawl 48 downwardly, the nose 68, as shown in Figure 12, thus coming into engagement with the next tooth 40. As the reeling in continues, pin 44 continues to move counterclockwise, as shown in Figures 13 and 14, until it abuts against the left-hand end of slot 50. It will now be understood that the ratchet-pawl mechanism has been returned to precisely the starting point shown in Figure 3, namely, where it prevents the spring motor from reeling in any more of cable 9.

If it is now desired to permit the spring motor to reel in all or a substantial portion of cable 9, a length of cable is unreeled to permit pawl 48 to be positioned, as shown in Figure 4, i.e., with nose 68 having just been freed from tooth 40. The spring motor is then permitted to take over and reel in before the position of pawl 48 with respect to pin 44 is changed by the engagement of the leading end of pawl 48 with the next tooth 40. Thus, with the pin 44 remaining in the position shown in Figure 4, spring 56 continues to keep the nose 68 of latch 48 pivoted upwardly so that it will not engage the teeth 40. If it is then desired to reel out more cable, the sequence will be precisely as previously described in connection with Figures 5, 6 and 7 etc.

Figures 15 through 17 illustrate the action of pin 76 in the event of a weak spring 56. Figure 15 is comparable to Figure 6 and shows the reel going in the unreeling direction with the leading end of pawl 48 engaging the adjacent tooth 40. Figure 16 shows pin 44 having advanced clockwise well beyond the center line of pawl 48 with the spring 56 having failed to pivot pawl 48. Figure 17 shows pin 76 in engagement with the upper surface of pawl 48 and having cammed the leading end upwardly out of engagement with the adjacent tooth 40. As indicated previously, pin 76 is not necessary for the proper operation of the reel 2. It is desirable where in extended usage spring 56 might become weak or in the event that it is desired to use, at the outset, a relatively weak spring 56.

Alternative embodiments

Alternatively, the ratchet-pawl device in accordance with this invention is equally applicable to structures having relative linear movement.

As shown in Figure 18, a ratchet 102 is mounted on a window frame 104. Secured to a window sash 106 having a glass pane 108 is a pawl mechanism indicated at 110. Pawl mechanism 110 comprises a pawl 112 having a slot 114 mounted on a headed pin 116 secured to sash 106. A torsion spring 118 is secured on the center line of slot 114 at 120 and is also secured at 122 to a block 124 which, in turn, is secured to sash 106. The pawl mechanism 110 is protected by a casing 126. It is believed that it will be readily apparent that the operation of the ratchet-pawl mechanism of Figure 18 is the same as that previously described for the mechanism of Figure 1, the essential difference being simply that the weight of the window sash 106 and pane 108 act as the biasing force, i.e., act to move the window downwardly.

A still further alternative embodiment is shown in Figures 20, 21 and 22. This embodiment is suitable for a linear application such as discussed in connection with Figures 18 and 19. Referring to Figure 20, a ratchet 130, which can be secured, for example, to a window frame, has teeth 132 with an undercut portion indicated at 134 at the upper end of each tooth. Cam portion 135 of ratchet 130 acts to cam pawl 140 outwardly as it is moved upwardly. A pawl mechanism indicated at 136 has a bracket 138 which, for example, can be secured to a window sash 139. A pawl 140 has a slot 142 through which passes a headed pin 144 which is secured to bracket 138. A torsion spring 146 has one end secured to pawl 140 at 148 on the center line of slot 142 and the other end secured to bracket 138 as shown at 150. A slot 149 in bracket 138 provides freedom of movement for the end of the spring 146 secured to the pawl. The lower end of pawl 140 has a nose 152 which is adapted to pass inside and engage the undercut portion 134 of tooth 132.

Here, again, it is believed obvious that the ratchet-pawl mechanism of Figures 20–22 operates essentially as described for the embodiment of Figure 1, the major difference being the nose 152 and undercut portion 134 are of greater extent to require a greater back travel before the pawl becomes disengaged from the ratchet tooth holding it. This is advantageous where heavy vibration or jarring is expected.

Figures 23 through 25 illustrate an alternative embodiment of the ratchet-pawl mechanism in accordance with this invention eliminating the use of a slot in the pawl. It will be appreciated that the invention simply requires that the pawl be rockably mounted and capable of being moved off center with respect to resilient means which will cause the pawl to rock clockwise or counterclockwise depending upon the direction of its displacement. This is accomplished through the use of a link in the

embodiment of Figures 23 through 25 rather than through the use of a slot.

As shown in Figures 23–25, a ratchet-pawl mechanism **160** has a ratchet wheel **162** with teeth **164** each having an undercut portion **166**. Ratchet wheel **162** is secured against rotation by means not shown. A pawl **168** is pivotally secured to the lever **170** at **172** and lever **170** is, in turn, pivotally secured to a rotating disc **174** at **176**. A torsion spring **178** has one end secured to pawl **168** at **180** and the other end secured to a block **182** at **184**. Block **182** is secured to rotating disc **174**. A pair of stop pins **186** and **188** are secured to disc **174** and extend outwardly to act as stops for lever **170**. As shown in Fig. **23**, when link **170** is centered between stops **186** and **188** and when pawl **168** is centered with respect to lever **170**, the ends of torsion spring **178** are secured in a plane passing through the pivot points of lever **170**.

The embodiment of Figures 23–25 operates fundamentally the same as the embodiment of Figure 1. It will be appreciated that the position of the pawl **168** and lever **170** was selected for purposes of best illustrating the construction involved. However, the structure would never assume the position illustrated in Figures 23 and 24 in actual operation. The structure is shown in Figure 25 in a position to arrest counterclockwise movement of disc **174**. In this position tooth **164** has arrested the movement of pawl **168** which, in turn, has caused lever **170** to be shifted to the right as viewed in Figure 25 against stop pin **188**. Torsion spring **178** is also urging lever **170** to the right and further is attempting to pivot the right-hand end of pawl **168** downwardly which is prevented by engagement of the undercut portion **166** with the left-hand end of the pawl. A short rotation of disc **174** clockwise, as viewed in Figure 25, would release pawl **168** from tooth **164** and the pawl would then be pivoted so that it would be in a position permitting the free counterclockwise movement of disc **174**. If a still further clockwise movement of disc **174** is carried out, the right-hand end of pawl **168** will be biased downwardly into engagement with the next tooth **164**. This will result in the shifting of lever **170** to the left over center to a position where spring **178** will act to pivot pawl **168** counterclockwise as viewed in Figure 25 and free of tooth **164**. With the pawl in this position, disc **174** can be freely rotated clockwise as much as is desired and, when its rotation is reversed, pawl **168** will return to the position shown in Figure 25.

It is not desired to be limted except as set forth in the following claims.

What is claimed is:

1. A stationary ratchet member in the form of a disc having formed in the outer periphery thereof at least one radially inwardly extending recess terminating at opposite ends in circumferentially widely spaced opposed ratchet tooth defining shoulders, a member revolvable about the axis of said ratchet member, a pawl having a length exceeding the distance between said shoulders and an elongated opening formed therein, a pivot element mounted upon said revolvable member and freely projected through said opening, said pawl being shiftable relative to said pivot element within the limits of said elongated opening, and being disposed radially outwardly from said ratchet member, and spring means reacting between said revolvable member and said pawl and adapted for pivoting said pawl for urging one end portion of said pawl into engagement with one of said shoulders when said pivot element is accommodated by one end portion of said elongated opening, and for urging the opposite end portion of said pawl into engagement with the other of said shoulders when said pivot element is accommodated by the other end portion of said elongated opening.

2. A stationary ratchet member in the form of a disc having formed in the outer periphery thereof at least one radially inwardly extending recess terminating at opposite ends in circumferentially widely spaced opposed ratchet tooth defining shoulders, one of which shoulders is undercut, a member revolvable about the axis of said ratchet member, a pawl having a length exceeding the distance between said shoulders and an elongated opening formed therein, a pivot element mounted upon said revolvable member and freely projected through said opening, said pawl being shiftable relative to said pivot element within the limits of said elongated opening, and being disposed radially outwardly from said ratchet member, and a torsion spring reacting between said revolvable member and said pawl and adapted for pivoting said pawl for urging one end portion of said pawl into engagement with the undercut shoulder aforesaid when said pivot element is accommodated by one end portion of said elongated opening, and for urging the opposite end portion of said pawl into engagement with the other of said shoulders when said pivot element is accommodated by the other end portion of said elongated opening, the undercut shoulder aforesaid being operative for releasably holding the end portion of the pawl engaged therewith against the influence of said torsion spring when said pivot element is accommodated by the first-mentioned end portion of said elongated opening.

3. A stationary disc having formed in the outer periphery thereof at least one radially inwardly extending recess terminating at opposite ends in circumferentially widely spaced opposed ratchet tooth defining shoulders, a member revolvable about the axis of said disc, a pawl member having a lentgh exceeding the distance between said shoulders, a pivot element mounted upon one of said members and freely projected through an elongated opening formed in the other of said members, said pawl being shiftable relative to said revolvable member within the limits of movement of said pivot element in said elongated opening, and being disposed radially outwardly from said ratchet member, and spring means reacting between said revolvable and pawl members and adapted for pivoting said pawl for urging one end portion of said pawl into engagement with one of said shoulders when said pivot element is accommodated by one end portion of said elongated opening, and for urging the opposite end portion of said pawl into engagement with the other of said shoulders when said pivot element is accommodated by the other end portion of said elongated opening.

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