United States Patent

Tsukuma et al.

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[54] DEVICE FOR CONTROLLING YARN WINDING PRESSURE ON A PACKAGE

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[21] Appl. No.: **855,597**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 608,150, Jan. 9, 1967, Pat. No. 3,510,078.

[52] **U.S. Cl.** .....**242/18 R**, 242/43

[51] **Int. Cl.** **B65h 54/02**, B65h 54/28

[58] **Field of Search**.....242/18, 18 AB, 18 G, 43

[56] **References Cited**

UNITED STATES PATENTS

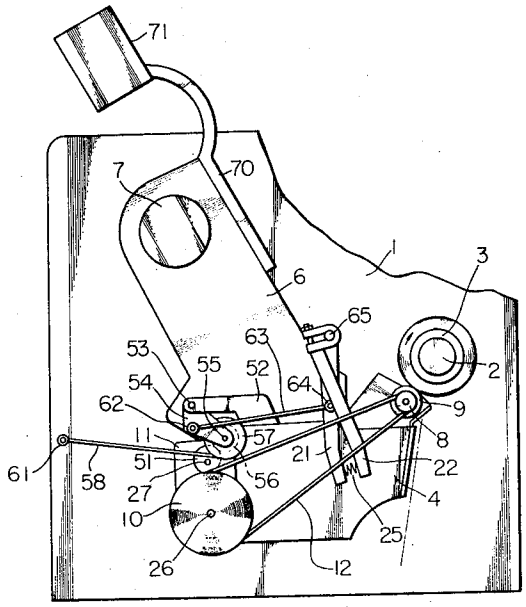
2,335,975	12/1943	Stahl et al.	242/18
2,463,773	3/1949	Jencks	242/18
2,466,600	4/1949	Lawson	242/18 X
2,740,589	4/1956	Keith	242/18
2,740,590	4/1956	Keith	242/18
2,769,299	11/1956	Keith	242/18 X
2,972,450	2/1961	Brierley	242/18
3,367,587	2/1968	Klink et al.	242/18 G

Primary Examiner—Stanley N. Gilreath
Attorney—Robert E. Burns and Emmanuel J. Lobato

[57] **ABSTRACT**

The invention relates to improvements in mechanism for controlling the winding pressure on a package in precision winders of the type having a roller bail extending along the whole length of the package being wound. Increases in the diameter of the winding package causes the roller bail to contact the package which results in rotation of the roller bail. The rotation of the roller bail is transmitted through a speed reduction device to a roller bail receding or retracting means which effects movement of the roller bail away from the peripheral surface of the package. The means for effecting the retracting movement of the roller bail is materially simplified for easier resetting of the device at the time of package doffing and for reducing contacting pressure between the package and the roller bail to an extremely low point. A linear flexible connector is fixed at one end to the frame of the machine and at its other end to a winding drum rotatably mounted on a pivotal arm that supports the roller bail. Slight rotation of the roller bail due to contact with the periphery of the package is transmitted through the speed reduction device to rotate the winding drum to wind up thereon the linear connector. The shortening of the linear flexible connector by the winding operation causes the arm supporting the roller bail to swing about its pivot very slightly to thus move or retract the roller bail away from the package.

6 Claims, 4 Drawing Figures



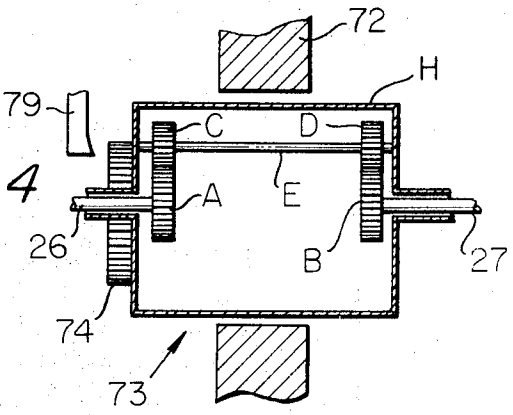

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Fig. 4

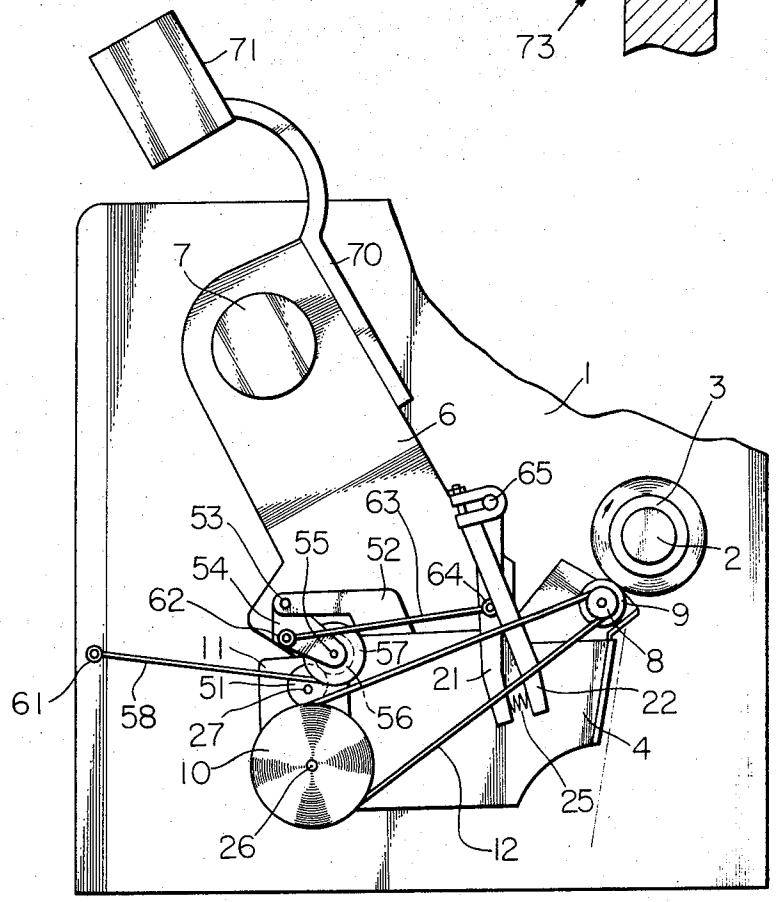
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Fig. 1

Fig. 2

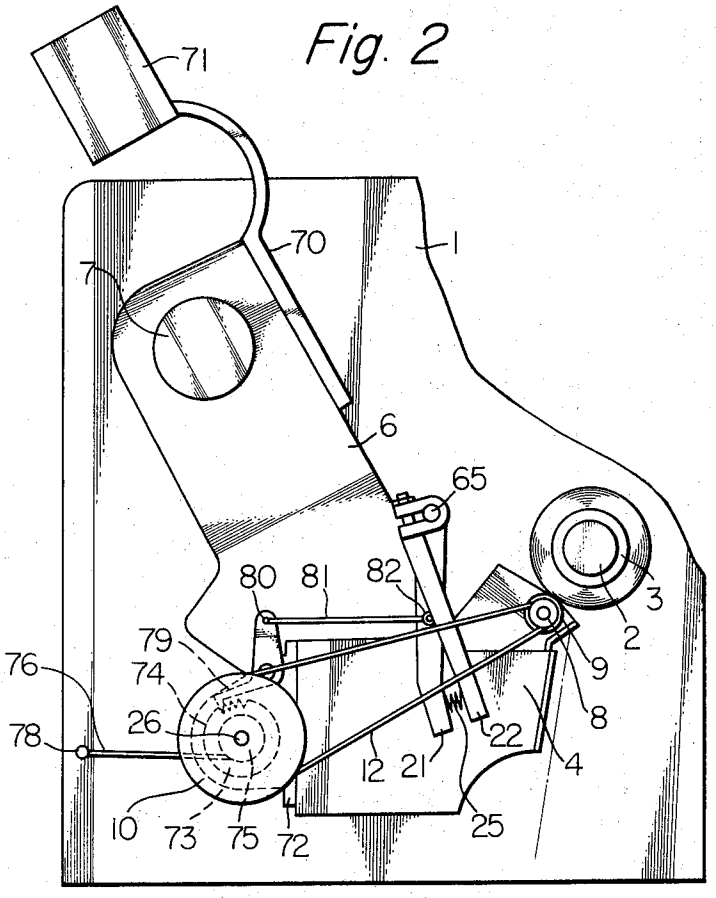
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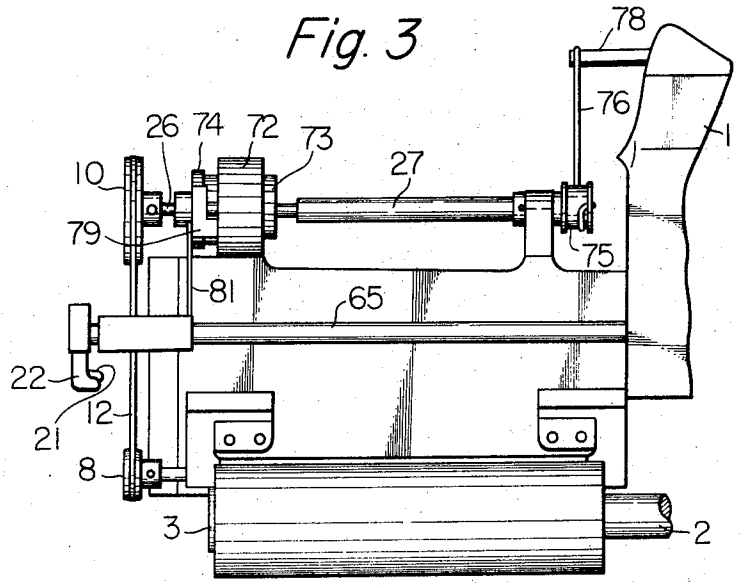
Fig. 3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DEVICE FOR CONTROLLING YARN WINDING PRESSURE ON A PACKAGE

This application is a continuation-in-part of our copending application Ser. No. 608,150 filed on Jan. 9, 1967, now U.S. Pat. No. 3,510,078 granted May 5, 1970.

In the prior application, a device for controlling winding pressure on a package used in a precision winder having a roller bail extending along a whole length of a package is disclosed. The frictional rotation of the roller bail, due to contact with the package peripheral surface during winding operation, is advanced into a roller bail mechanical receding means through means for actuating the roller bail's backing away motion by the mechanical receding means in response to the roller bail's frictional rotation and the roller bail recedes from contacting with the package's peripheral surface as the package diameter increases. The actuating means contains a speed reduction device having a rotatable input and output shaft, the former accepting mechanical signals and force caused by the rotation of the roller bail and the latter effecting operation of the mechanical receding means in response to the accepted mechanical signals and force.

Although a considerable advance in the art was attained in the yarn winding pressure controlling operation by the device disclosed in the prior application, there still exists some operational troubles and difficulties to be solved by further improvement. The present invention is purposed for mitigating the referred troubles and difficulties inevitably possessed by the prior controlling system. For example, the relatively complex mechanical structure of the quoted device entails an increase in the manufacturing and/or maintenance costs thereof. It is further pointed out that the roller bail receding motion on the prior device is dependent upon the referred combination of the gears and the gears must be urged toward each other for a stable meshing condition therebetween. Due to the need for this urging force, the pressure developed between the roller bail and the package periphery tends to be undesirably increased.

The present invention relates to an improvement in a device for controlling yarn winding pressure on a package, more particularly relates to an improvement in the construction of the above-described mechanical actuating means for effecting the backing of the roller bail away from the contacting the package's peripheral surface.

A principal object of the present invention is to provide an improvement in a device for controlling yarn winding pressure on a package whereby all the drawbacks inevitably possessed by the device of the quoted type are completely eliminated.

In order to attain the above-described objects of the invention, the improvement of the present invention is characterized by a cord-like member one end of which is fixed to a frame-work of the winder and the other end of which is connected to the roller bail supporting means by a winding-up element. The winding-up element is related to the output shaft of the speed reduction device. By the rotation of the roller bail, due to peripheral contact with the package, the winding up element winds up the cord-like member and the roller bail supporting means tends to move towards the fixed end of the cord-like member thus effecting movement of the roller bail away from contacting the package.

Further features and advantages of the present invention will be more fully apparent from the ensuing description, reference being made to the accompanying drawings in which;

FIG. 1 is a side view, partly omitted, of an embodiment of the improvement according to the present invention,

FIG. 2 is a side view, partly omitted, of another embodiment of the improvement according to the present invention,

FIG. 3 is a plan view, partly omitted, of the embodiment shown in FIG. 2, and

FIG. 4 is a cross-sectional view of the gear reduction device employed in the FIG. 2 embodiment.

Referring to FIG. 1, an embodiment of the improvement of the present invention is shown. In the embodiment, a spindle 2 is rotatably supported by a winding unit 1 and a bobbin 3 for holding yarn layers is mounted on the spindle 2. An arm 6 is

pivoted at its one end to a shaft 7 secured to the winding unit 1 and to another end of the arm 6, a cam box 4 is secured. In the cam box, a cam mechanism for actuating a traversing motion of a traverse yarn guide is contained. The spindle 2 is driven by a power transmission mechanism (not shown) in a direction shown by an arrow in the drawing, while the spindle 2 is related to the cam mechanism of the cam box 4 so as to wind the yarn around the bobbin 3.

In the vicinity of the bobbin 3, a roller bail 9 is disposed to the cam box 4 which is carried by arm 6. The disposition of the roller bail 9 is so designed as to be adapted to contact the peripheral surface of the winding yarn package and extends along the whole length of the package. A pulley 8 of small diameter is secured to an end of the roller bail 9 and a reduction device 11 is secured to the cam box 4 on the far side opposite to the roller bail 9 in such a way that the reduction device 11 can swing with the cam box 4 as the arm 6 moves about the shaft 7. A pulley 10 of large diameter is mounted on an input shaft 26 of the reduction device 11. Rotation of the large pulley 10 is caused by the rotation of the roller bail 9 by way of a belt drive 12. Due to the difference in diameter of both pulleys 8 and 10, the rotating speed of the input shaft 26 is reduced from that of the roller bail 9. A gear wheel 51 is firmly mounted to the output shaft 27 of the reduction device 11. At a free end of a bracket 52 secured to the upper surface of the cam box 4, a lever 54 is pivotally disposed to a shaft 53 laterally extruding from the bracket 52. A free end of the lever 54 is provided with a laterally projecting shaft 55 on which a winding drum 57 is rotatably mounted. Adjacent to this winding drum 57 and fixed to rotate therewith, a gear wheel 56 is mounted on the shaft 55 and adapted to mesh with the gear wheel 51 of the reduction device 11.

In addition, a pin 61 is fixed to the framework 1 of the winding unit at a position to the left of the reduction device 11 as shown in the drawing. A flexible cord 58 is disposed to the above-described mechanism with its one end fixed to the pin 61 and its other end fixed onto a periphery of the winding drum 57 so that the cord can be wound thereon. At a position adjacent to the shaft 7 remote from the cam box 4, a lever 70 extends from the arm 6 and is provided with a balancing weight 71 at its free end.

In the above-described mechanical arrangement, the operation of the mechanism is as follows.

The arm 6 is always lightly urged counterclockwise around the shaft 7 in the drawing due to the presence of the balancing weight 71, that is, the roller bail 9 is always retained in slight contact with the periphery of the package. On slight rotation of the roller bail 9 due to contact with the rotating package, the output shaft 27 of the reduction device 11 rotates accordingly. This rotation of the output shaft 27 causes a rotation of the winding drum 57 around the shaft 55 by way of the gear wheels 51 and 56 and the cord 58 tends to be wound up on the periphery of the winding drum 57. Because the cord 58 is fixed to the pin 61 at its one end and the arm 6 is pivotally or turnably mounted on the shaft 7, the thus created tension on the cord 58 tends to pull the cam box 4 towards the pin 61, that is, the arm 6 fixedly supporting the cam box 4 is turned slightly around the shaft 7 against the counterclockwise urging of the balancing weight 71. Thus, the roller bail 9 carried by the cam box 4 recedes slightly away from the periphery of the package. This extremely slight receding movement of the roller bail 9 is followed by an increase in the package diameter and is caught soon after. As soon as the package of increased diameter once again comes in contact with the roller bail 9, the roller bail once again starts to rotate and the above-described operation cycle is repeated.

For the purpose of manual resetting of the apparatus, a pair of levers 21 and 22 may be disposed to the arm 6 with one lever 21 of the two turnably mounted on a shaft 65 secured to the arm 6 and the other lever 22 fixedly mounted thereto by a suitable set screw as shown in FIG. 1. A spring 25 is inserted in between the two levers 21 and 22 biasing them apart.

In this embodiment, the lever **21** is provided with a lateral projection **64** formed on its stem portion and the lever **54** is also provided with a lateral projection **62** formed on its stem portion. Both lateral projections **62** and **64** are connected by a link **63**. At the time of resetting the apparatus, the free ends of the levers **21** and **22** are gripped against the expanding force of the intervening spring **25**. Then, the counterclockwise turning of the lever **21** around the shaft **65** turns the lever **54** around the shaft **53** by way of the link **63**, and the gear wheel **56** is released from engagement with the gear wheel **51**, so as to enable manual resetting of the apparatus.

Still another modification of the embodiment shown in FIG. **1** is shown in FIGS. **2–4**. In this embodiment, a reduction device **73** having a cylindrical configuration is rotatably mounted in a a holder or supporting means **72** mounted on one side of the cam box **4** remote from the roller bail **9**. The holder **72** therefore functions as a bearing for rotatably supporting the reduction device **73**. This reduction device **73** is provided with an input shaft **26** and an output shaft **27** in such a manner that the axial center lines of the three numbers are in axial alignment. The output shaft **27** of the reduction device **73** is provided with a winding drum **75** secured to a free end thereof, and a flexible cord **76** is fixed to the periphery of the winding drum **75** and extends to a pin **78** secured to the frame work of the winding unit **1**. At one side and adjacent to the periphery of the reduction device housing **73** is connected a ratchet wheel **74** which is fixed thereto for rotation therewith within the holder and an L-shaped ratchet pawl **79** is pivotally mounted at its apex to the stationary holder **72**. The pawl of the ratchet **79** releasably engages with the teeth of the ratchet wheel **74** of the reduction device **73** to releasably lock the housing of the reduction device to the support **72** thereby enabling rotation of the input shaft **26** to be transmitted through the gear reduction ratio of the reduction device to the output shaft **27** and the other end of the ratchet pawl lever **79** is provided with a lateral pin **80**. A link **81** connects the pin **80** of the ratchet arm **79** with a pin **82** laterally formed on a stem of the lever **21**. The arm **6** is also provided with a balancing weight **71** for the purpose as described in the preceding embodiment.

The reduction device **73** comprises a cylindrical housing H and the ratchet wheel **74** is secured to one end of the housing H. The housing is mounted for rotation within the support holder **72** and when the pawl **79** is engaged with the ratchet wheel **74**, the housing of the reduction device is held stationary and when the pawl **79** is disengaged from the ratchet wheel, the housing of the reduction device may rotate relative to the support holder **72**.

The internal structure of the reduction device **73** is conventional and well-known in the art and a simplified showing of the internal workings of the reduction device is shown in FIG. **4** wherein it may be seen that the input shaft **26** has a gear A connected to one end thereof and in a similar manner, the output shaft **27** is connected at one end to a gear B. Additional gears C and D are respectively in mesh with the gears A and B and these gears are affixed to a shaft E. The size and number of teeth on the gears A, B, C, D are suitably chosen to effect a reduction ratio of, for example 1/500, with respect to the rotation of the input shaft **26** relative to the output shaft **27**.

In the above-described mechanical arrangement of the embodiment, the rotation of the roller bail **9** due to contact with the periphery of the rotating package causes rotation of the output shaft **27** of the reduction device **73** together with the rotation of the winding drum **75**. Thus, created tension of the cord **76** causes clockwise turning of the arm **6** around the shaft **7** in the drawing against the counterclockwise urging effect of the balancing weight **71**. The the roller bail **9** mounted on the cam box **4** is receded slightly away from the periphery of the package. The mode of repetition of the above-described receding or retracting operation in relation to the increase in the package diameter is the same as that described in the preceding embodiment.

With respect to manual resetting of the apparatus, the engagement of the pawl of the ratchet lever **79** with the ratchet wheel **74** peripherally disposed on the reduction device **73** is broken by gripping the free ends of the levers **21** and **22** and pressing them together against the biasing force of the spring **25**. After the pawl is disengaged from the ratched wheel **74**, the reduction device **73** may be rotated as desired by hand relative to the input shaft **26** for completing the resetting operation without effecting rotation of the roller bail **9**.

When the pawl **79** is disengaged from the ratched wheel **74**, the reduction device **73** is free to rotate in the holder **72** without a corresponding rotation of the input shaft **26**. So, when the arm **6** is turned counterclockwise around the shaft **7** by manually forcing the levers **21** and **22**, any rotation imparted directly to the output shaft **27** effects a corresponding rotation of the reduction device **73** around the input shaft **26** which does not rotate but remains stationary due to the heavy loading on the shaft.

Although a balancing weight is used for urging the roller bail toward the package in the above-described modified embodiments, any type of urging mechanism, for example a spring, can be used for this purpose without departing from the scope of the invention.

Further, in the referred embodiments, any linear connector can be substituted for the links **63** and **81** if any suitable additional means for effecting engagement between the gears **51** and **56** or ratchet pawls **79** and ratchet wheels **74** is employed.

What is claimed is:

1. In a precision winder mechanism for winding a package on a rotationally driven spindle of the type provided with a rotatable roller bail extending along the length of the package; means for mounting said rotatable roller bail in a position to lightly contact the peripheral surface of said package and for effecting frictional rotation of said roller bail during said winding operation, said means comprising a support arm pivotally mounted on a stationary shaft fixed to the frame of the machine, support means carried by said arm for supporting said rotatable roller bail, and means for urging said roller bail towards said package; and means for moving said arm and roller bail away from contact with said package, said last mentioned means comprising a speed reduction device carried by said arm and provided with rotatably mounted input and output shafts, means for transmitting rotational movement of said roller bail to said input shaft at a given transmission ratio, a first gear fixed to said output shaft, a second gear rotatably mounted on said support means in releasable meshing engagement with said first gear, a winding drum coaxially disposed and fixed to said second gear, and a flexible linear connector fixed at one end to a stationary part of the machine frame and at the other end to the periphery of the winding drum, whereby rotation of said roller bail effects rotation of said winding drum to wind thereon said linear connector to thereby rotate said arm and said roller bail away from said package.

2. A precision winder mechanism as defined in claim **1**, including means for manually disengaging said second gear from said first gear.

3. Improvement as claimed in claim **2**, wherein said means for manually disengaging said second gear from said first gear comprises another shaft secured to said arm, a first lever secured to said other shaft, a second lever turnably mounted on said other shaft, a spring disposed in between said two levers normally biasing them apart, a second arm rotatably supporting said second gear and pivotally mounted on said support means and a linear connector for connecting said second lever to said second arm; whereby said first and second gears are disengaged by manually pressing said first and second levers together.

4. In a precision winder mechanism for winding a package on a rotationally driven spindle of the type provided with a rotatable roller bail extending along the length of the package; means for mounting said rotatable roller bail in a position to lightly contact the peripheral surface of said package and for

effecting frictional rotation of said roller bail during said winding operation, said means comprising a support arm pivotally mounted on a stationary shaft fixed to the frame of the machine, support means carried by said arm for supporting said rotatable roller bail, and means for urging said roller bail towards said package; and means for moving said arm and roller bail away from contact with said package, said last mentioned means comprising a speed reduction device rotatably mounted on said support means including rotatably mounted input and output shafts with the axial center lines of said speed reduction device and said shafts being in axial alignment, means for transmitting rotational movement of said roller bail to said input shaft at a given transmission ratio, a winding drum fixedly mounted on said output shaft, a flexible linear connector fixed at one end to a stationary part of the machine frame and at the other end to the periphery of the winding drum, a ratchet wheel fixed to a side of said speed reduction device, a ratchet pawl lever pivoted on said support means and positioned to releasably engage with said ratchet wheel, and means to normally effect engagement of said ratchet pawl with said ratchet wheel, whereby rotation of said roller bail effects rotation of said winding drum to wind thereon said linear connector to thereby rotate said arm and said roller bail away from said package.

5. A precision winder mechanism as defined in claim **4**, including means for manually disengaging said pawl from said ratchet wheel.

6. Improvement as claimed in claim **5**, wherein said means for manually disengaging said pawl from said ratched wheel comprises another shaft secured to said arm, a first lever secured to said other shaft, a second lever turnably mounted on said shaft, a spring disposed in between said two levers normally biasing them apart, and a linear connector connecting said ratchet pawl to said second lever, whereby said ratchet pawl is disengaged from said ratchet wheel by manually pressing said first and second levers together.

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