A toilet paper dispenser is provided that is operable in an automatic dispensing mode and a manual dispensing mode. The dispenser comprises a housing for containing a toilet paper roll; a drive roller engageable with the roll; a motor; and a one-way coupling that couples the motor to the drive roller in a first direction to automatically dispense paper from the dispenser and decouples same in an opposite second direction, thereby enabling toilet paper to be manually dispensed in the first direction.
FIG. 9
AUTOMATED TOILET PAPER DISPENSER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 11/243,100, filed on Jun. 8, 2006, now pending, which is a continuation-in-part of U.S. patent application Ser. No. 11/245,585, filed on Oct. 7, 2005, now pending, where these two applications are incorporated herein by reference in their entireties.

FIELD OF THE INVENTION

[0002] This invention relates generally to paper dispensers and particularly to away-from-home type toilet paper dispensers.

BACKGROUND OF THE INVENTION

[0003] A common concern in providing toilet paper in public facilities is wastage and theft of toilet paper. Known toilet paper dispensers, whether single roll or double roll, dispense a user-selectable portion of the toilet paper roll stored in the dispenser. The toilet paper roll may be perforated, in which case the user unwinds a desired number of perforated segments from the roll then tears the segments away from the roll along one of the perforations. Alternatively, the toilet paper roll may be non-perforated, in which case the user must press the paper roll portion against a knife, a serrated edge or other severing means in the dispenser to separate the portion from the roll.

[0004] In both cases, the user has unlimited access to the roll of toilet paper in the dispenser. Wastage occurs when the user pulls a long portion of the roll from the dispenser and does not use it, leaving the portion hanging out of the dispenser and/or laying on the floor. Worse, abuse can occur by unwinding the entire roll and stealing the paper, or leaving the paper unused and wasted.

[0005] Another problem with known toilet paper dispensers is that users typically have to reach under the dispensers to grab the leading edge of the toilet paper roll, then pull the leading edge downwards in order to extract paper from the dispenser. This can be an awkward process, especially if the dispenser is mounted low, or if there is an insufficient tail protruding under the dispenser for the user to obtain a firm grip. Persons with disabilities or restricted mobility can find operating such dispensers to be particularly challenging. Sometimes when the paper is particularly fragile or when the roll is difficult to rotate, the paper segment separates from the roll by the downwards pull by the user, leaving the user with a much shorter portion than intended.

[0006] Some dispensers are provided with a rotary knob on the exterior of the dispenser to aid the user in dispensing paper. However, many users are reluctant to touch the dispenser, as such dispensers can be dirty and can contain bacteria or other unhygienic material.

[0007] In view of the above, it would be desirable to provide a toilet paper dispenser that can solve at least some of the shortcomings of present toilet paper dispensers.

BRIEF SUMMARY OF THE INVENTION

[0008] It is a general objective of the invention to provide a hands-free toilet paper dispenser that solves at least some of the problems in present toilet paper dispensers. A particular objective of the invention is to provide an improved toilet paper dispenser that can automatically advance a toilet paper portion of predetermined length for the user. A further objective of the invention is to provide a toilet paper dispenser that can operate in both an automated dispensing mode and a manual dispensing mode.

[0009] According to one aspect of the invention, there is provided a toilet paper dispenser comprising a housing for containing a toilet paper roll; a drive roller engageable with the roll; a motor; and a one-way coupling that couples the motor to the drive roller in a first direction to automatically dispense paper from the dispenser and decouples same in an opposite second direction, thereby enabling toilet paper to be manually dispensed in the first direction.

[0010] The dispenser can have a manual dispensing means that is rotationally coupled to the toilet paper roll and operable by a user to rotate the roll in the first direction to manually dispense paper from the dispenser. The dispenser can further comprise a roll support rotatably coupled to the housing and which serves to receive a core of the roll. In such case, the manual dispensing means is a knob coupled to the roll support and operable to rotate the roll support thereby rotating the roll.

[0011] The dispenser can further comprise a sensor mounted on the housing and a controller communicative with the sensor and the motor. The controller is programmed to operate the motor when the sensor is activated. A power supply such as a battery can be electrically coupled to the motor to provide power thereto.

[0012] The drive roller can be positioned in the housing to engage a leading edge of the roll. When the roll is perforated, a secondary pair of pinch rollers can be provided to grip the leading edge of the roll and prevent perforations in the leading edge of the roll from breaking about the drive roller. When the roll is non-perforated, severing means like a knife can be provided to sever a dispensed portion from the roll.

[0013] Alternatively, the drive roller can be positioned in the housing to engage the surface of the roll. In such case, the drive roller can be movably connected to the housing thereby being movable to maintain contact with rolls of varying diameter. More particularly, the drive roller can be movably connected to the housing by a track in the housing in which the roller is slidably therealong. Biasing means can be provided to bias the roller against the roll. The motor can be suspended from the roller thereby serving as the biasing means.

[0014] Alternatively, the drive roller can be the roll support that receives a core of the roll. In such case, the roll support is rotationally coupled to the motor by one way bearing. Manual dispensing means can also be rotationally coupled to the roll support to allow a user to manually dispense portions from the roll.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0015] FIGS. 1(a) to (d) are respective front elevation, top plan, side elevation and perspective views of an automated toilet paper dispenser according to one embodiment of the invention.
FIG. 2 is a schematic block diagram view of certain components of the toilet paper dispenser.

FIGS. 3(a) and (b) are side and perspective views, respectively, of a motor and gears for coupling to rollers of the dispenser. FIG. 3(c) shows the motor and gears coupled to a drive roller and driven roller of the dispenser.

FIGS. 4(a) to (d) are respective front elevation, top plan, side elevation, and back elevation (with battery pack removed) views of an automated toilet paper dispenser according to a second embodiment of the invention.

FIG. 5 is a schematic block diagram view of certain components of the toilet paper dispenser according to the second embodiment of the invention.

FIGS. 6(a) to (c) are respective front elevation, top plan, and side elevation views of an automated toilet paper dispenser according to a third embodiment of the invention.

FIG. 7 is a schematic block diagram view of certain components of the toilet paper dispenser according to the third embodiment of the invention.

FIG. 8 is a schematic block diagram of certain components of the toilet paper dispenser modified to dispense a perforated toilet paper roll.

FIG. 9 is a perspective view of a portion of a two-roll toilet paper dispenser according to another embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Directional terms such as "top", "bottom", "right", and "left" are used in this description merely to aid the reader understand the embodiments of the invention and are not to be construed as limiting the embodiments to any particular orientation during operation or in connection to another apparatus.

According to one embodiment of the invention and referring to FIGS. 1(a) to (d), a toilet paper dispenser 10 is provided that is particularly suited for away-from-home use. The dispenser 10 is motorized and has a sensor 12 that can be activated by a user to cause the dispenser 10 to automatically dispense a portion of a toilet paper roll A stored inside the dispenser 10 (toilet paper roll A not shown in FIG. 1(d)). The dispenser 10 is also provided with a manual dispense mechanism 14 which enables the user to manually cause the dispenser 10 to dispense toilet paper, e.g. in the event of a power failure or a dead battery that causes the automatic dispensing feature to stop working.

As can be seen in FIG. 1(c), the dispenser 10 has a housing 16 and a door 18 hingedly coupled to the housing 16 by hinges 20 at the bottom of the housing 16. The door 18 can be locked by a locking mechanism 22 located at the top of the housing; such locking mechanism 22 is a conventional key-based lock and is thus not described in detail here. The door 18 can be unlocked and opened to allow the loading of the toilet paper roll A. A dispensing opening 24 is provided at the bottom of the housing for toilet paper to be dispensed therethrough.

Referring to FIG. 2, the dispenser 10 comprises a number of components that work together to automatically dispense a portion of the toilet paper roll (hereinafter "automatic dispensing assembly"). The automatic dispensing assembly comprises a motor 26 electrically coupled to a battery pack 28 and a drive roller 30. A control circuit 31 is electrically communicative with the sensor 12 and the motor 26 and is programmed to actuate the drive roller 30 when a signal is received from the sensor 12. In this embodiment, the sensor 12 is located on the housing door 18 but can be optionally located elsewhere on the dispenser 10 in a place that enables a user to conveniently activate the sensor 12.

The toilet paper roll A as shown in FIG. 2 is a standard non-perforated core-type roll. A serrated knife 31 is provided near the opening 24 for severing a portion from the roll A. A user severs the portion from the roll A by pressing the portion against the knife 31. Alternatively, the knife 31 or another suitable cutting means can be movably mounted to the dispenser 10 and coupled to an actuator (not shown) which moves the knife 31 against a sheet of the roll A to sever the portion therefrom.

The roll A is loaded into dispenser 10 by sliding the hollow cylindrical core over a cylindrical support 32 extending horizontally from the housing 16. The support 32 is freely rotatably mounted to the vertical wall of the housing 16 and has a plurality of fins 33 that bite into the roll core, thereby creating a friction fit that causes the roll A to rotate with the roll support 32. Alternatively, the cylindrical support 32 is fixed to the housing 16 and is made of a low-friction plastic or similar material, or coated with a low friction material to enable the roll A to rotate freely about the fixed support 32 with minimum effort.

After the paper roll A is loaded in the dispenser and while the door 18 is still opened, the leading edge of the paper roll A is threaded between a pair of rollers, namely, the drive roller 30 and an adjacent free-spinning roller 34. One or both rollers 30, 34 are spring-mounted to the housing 16 to enable the rollers 30, 34 to be separated to form a gap and allow the leading edge of the roll A to thread through the gap. When the rollers 30, 34 are released, the springs (not shown) cause the rollers 30, 34 to apply a force onto the paper roll A.

The rollers 30, 34 have a rolling surface with a sufficient coefficient of friction that rotation of the roller surface 30, 34 will pull the paper roll A therethrough.

Referring to FIGS. 3(a)-(c), the drive roller 30 is rotationally coupled to the motor 26 by a one-way bearing 36 and a plurality of reduction drive gears 38(a)-(b). The motor 26 is a DC-powered gear head motor mounted on the base of the housing 16. A suitable motor is a Jameco Reliapro model 151440 with 4.5–12 VDC operating range and a no load speed of 69 RPM; however, other motors with similar specifications can be readily substituted. The motor 26 has a drive shaft 40 which connects a motor drive gear 38(a). The motor drive gear 38(a) is rotatably coupled to a roller drive gear 38(b). The roller drive gear 38(b) is fixed to an outside surface of the one-way bearing 36. The outside surface of the one-way bearing 36 is rotationally coupled to an inside surface of the one-way bearing 36 in a single direction as is known in the art. The inside surface of the one-way bearing 36 is in turn fixed to a shaft (not shown) coupled to the drive roller 30 and extending along the rotational axis thereof. The drive gears 38(a)-(b) serve as reduction gears between the motor 26 and drive roller 30.

The one-way bearing 36 is aligned to transfer torque from the motor 26 to the drive roller 30 and yet allow
the drive roller 30 to rotate freely in the drive direction. Therefore, when the motor 26 is not operating, the dispenser 10 can still be manually operated to dispense toilet paper by the user manually pulling downwards on the leading edge of the roll A protruding from the dispenser 10. The one-way bearing will allow the drive roller 30 to spin in the drive direction even though the motor 26 is not operating. The user can also use the manual dispensing mechanism 14 to assist in the manual dispensing of the roll A from the dispenser 10. This mechanism 14 comprises a knob located on the exterior of the door 18 and connected to the support 24. When the knob is rotated by the user, the support 24 rotates and paper is unwound from the roll A. (If the support 24 is fixed, the knob can be directly attached to the roll, e.g. by spikes that penetrate into the side of the roll A.)

[0034] The ability to manually dispense is particularly useful when power is unavailable to the motor 26, e.g. power outage or dead batteries. Without such one-way bearing 36, the rotational resistance presented by the reduction gears 38(a) and (b) and motor 26 would make it very difficult to rotate the drive roller 30. Additionally, the one-way bearing 36 allows the drive roller 30 to rotate at a faster rate than the rate as driven by the motor 26. This permits the user to manually advance the paper out of the dispenser 10 at a faster rate than is being advanced by the motor 26.

[0035] Although the use of a one-way bearing is described here, other one-way rotational couplings as known in the art can be substituted. Other suitable one-way couplings include one-way clutches and one-way ratchets.

[0036] Referring to FIG. 2, the motor 26 is one component of an automatic dispensing assembly that enables the dispenser 10 to automatically dispense toilet paper segments to the user. These components include the motor 26, the DC power supply 28, the control circuit 31, the sensor 12, and a door open disconnect switch (not shown).

[0037] The DC power supply 28 is electrically coupled to the motor 26 by the door open disconnect switch and the control circuit 31. In this embodiment, the DC power supply 28 is a battery pack capable of providing 6 or 9 volt output. Alternatively or additionally (but not shown), the DC power supply 28 can be an inverter that connects to an AC power source, e.g. a building’s AC power outlet. The inverter converts the AC power into DC for use by the motor 26. The door open disconnect switch is located on the dispenser 10 such that the switch opens when the door 18 is opened. This prevents the motor 26 from operating and causing injury when the door 18 is opened and dispenser 10 is being serviced.

[0038] The control circuit 31 includes a programmable logic controller (PLC) programmed to control the automatic dispensing operation of the dispenser 10. The control circuit 31 is electrically coupled and communicative with the sensor 12, the motor 26, the power supply 28 via the door open disconnect switch. The sensor 12 can be any type of sensor that detects the presence of the user, and can for example be a proximity sensor such as an IC digital capacitance sensor, a motion sensor, or an infrared sensor such as a pyroelectric sensor that detects the user’s body heat. The sensor 12 is powered by the power supply 28 via the control circuit 31. When the sensor 12 detects the user, it sends a user detected signal to the control circuit 31. The PLC of the control circuit 31 is programmed to check the sensor 12 and when detecting the user detected signal, to send a motor actuation signal to the motor 26. In response to the motor actuation signal, the motor 26 activates and rotates the drive roller 30 a selected number of rotations corresponding to a selected length of paper towel roll to be dispensed. This length can of course be adjusted by changing the programming of the control circuit 32.

[0039] The PLC is programmed to wait for a selected period of time before checking the sensor 84 again; this wait period provides the user with enough time to obtain and use the dispensed paper segment, leave the vicinity of the dispenser 10, or request another paper segment. The wait time also can serve to discourage a user meaning to waste paper by continually extracting paper from the roll.

[0040] Referring to FIG. 8, the dispenser 10 of this first embodiment can be modified to accept a standard perforated core-type roll B. Two pairs of rollers are provided to grip the roll sheet B, namely a pair of main rollers 30, 34 and a pair of secondary pinch rollers 39. At least one roller from each roller pair is spring-loaded so that continuous pressure can be applied to the roll sheet B. Like in the first embodiment, the main rollers comprise the drive roller 30 coupled to the motor 26 and the driven roller 34. The pinch rollers 39 are both free spinning and serve to prevent the perforations in the sheet from breaking about the main rollers 30, causing the tail of the sheet B to be lost within the dispenser 10. As the user can now easily tear a perforated portion from the sheet B, the cutting knife 31 is no longer required.

[0041] Referring to FIGS. 4(a)-(d) and 5 and according to a second embodiment of the invention, the automated dispensing assembly of the dispenser 10 is modified so that the rollers 30, 34 are replaced by a drive roller 100 which is in direct contact with the surface of the paper roll A. The drive roller 100 has an axle 102 that is movably mounted to the housing 16 and is biased against the paper roll A such that the drive roller 100 is always in contact with the roll A regardless of the roll’s size. The axle 102 extends through a track 104 in the housing 16 and is weighted at one end so that gravity biases the drive roller 100 downwards through the track 104 and against the roll A. Alternatively, the drive roller 100 can be biased using springs or other biasing means known in the art.

[0042] The surface of the drive roller 100 has a sufficient coefficient of friction to rotate the roll A when the motor 26 rotates the drive roller 100. The motor 26 is also movably mounted along the track 104 and is rotationally coupled to the drive roller 100 using the one way bearing and gears as described in the first embodiment. Alternatively, the motor 26 can be fixed to the housing 26 and rotationally coupled to the drive roller 100 using a series of gears and chain as is well known in the art (not shown).

[0043] Like the first embodiment, the drive roller 100 is coupled to the motor 26 by the one way bearing 36. Therefore, a user can manually operate the dispenser 10 either by pulling on the leading edge of the roll A, or turning the knob of the manual dispensing assembly 14, or both.

[0044] Referring to FIGS. 6(a)-(c) and 7 and according to a third embodiment of the invention, the automated dispensing assembly of the dispenser 10 is modified so that the support 32 is rotatably coupled to the housing 16, and is driven by the motor 26. In other words, the support 32 acts
as a drive roller, and is coupled to the motor 26 by the one way bearing and reduction gears as described in the previous embodiments. Like in the previous embodiments, the knob 14 is provided on the door 18 and is coupled to the support 32 such that rotation of the knob 14 by the user causes the support 32 to rotate and paper to be manually dispensed, whether or not the motor 26 is operating.

Because the roll A diameter diminishes as paper is dispensed, the length of toilet paper dispensed is not constant relative to the number of rotations of the roll support 32. Therefore, the dispenser 10 in this embodiment is provided with a roller sensor 50 which is in contact with the leading edge of the roll A. The control circuit 31 is programmed to determine the length of toilet paper dispensed from the measurements made by the sensor 50 then stop the rotation of the roll support 32 when the predetermined length has been dispensed. While a roller sensor is shown in this embodiment, other sensors can that can measure the length of paper dispensed be provided as is known in the art.

Although the present described embodiments all relate to a single roll toilet paper dispenser, it will be readily apparent to a person skilled in the art to adopt the automated and manual dispensing features of the single roll dispenser for a double roll dispenser such as the dispenser shown in FIG. 9.

All of the above U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in the Application Data Sheet, are incorporated herein by reference, in their entirety.

While the present invention has been described herein by the preferred embodiments, it will be understood to those skilled in the art that various changes may be made and added to the invention. The changes and alternatives are considered within the spirit and scope of the present invention.

1. A toilet paper dispenser comprising
(a) a housing for containing a toilet paper roll;
(b) a drive roller engangeable with the roll;
(c) a motor; and
(e) a one-way coupling that couples the motor to the drive roller in a first direction to automatically dispense paper from the dispenser and decouples same in an opposite second direction, thereby enabling toilet paper to be manually dispensed in the first direction.

2. A toilet paper dispenser as claimed in claim 1 further comprising a manual dispensing means rotationally coupled to the toilet paper roll and operable by a user to rotate the roll in the first direction to manually dispense paper from the dispenser.

3. A toilet paper dispenser as claimed in claim 2 wherein the dispenser further comprises a roll support rotatably coupled to the housing and for receiving a core of the roll, and wherein the manual dispensing means is a knob coupled to the roll support and operable to rotate the roll support thereby rotating the roll.

4. A toilet paper dispenser as claimed in claim 1 further comprising a sensor mounted on the housing and a controller communicative with the sensor and the motor, the controller programmed to operate the motor when the sensor is activated.

5. A toilet paper dispenser as claimed in claim 4 further comprising a power supply electrically coupled to the motor.

6. A toilet paper dispenser as claimed in claim 5 wherein the power supply is a battery.

7. A toilet paper dispenser as claimed in claim 4 wherein the drive roller is positioned in the housing to engage a leading edge of the roll.

8. A toilet paper dispenser as claimed in claim 4 wherein the drive roller is positioned in the housing to engage the surface of the roll.

9. A toilet paper dispenser as claimed in claim 8 wherein the drive roller is movably connected to the housing thereby being moveable to maintain contact with rolls of different diameters or a roll with varying diameter.

10. A toilet paper dispenser as claimed in claim 9 wherein the drive roller is movably connected to the housing by a track in the housing in which the roller is slideable therealong.

11. A toilet paper dispenser as claimed in claim 10 further comprising biasing means that bias the roller against the roll.

12. A toilet paper dispenser as claimed in claim 11 wherein the motor is suspended from the roller thereby serving as the biasing means.

13. A toilet paper dispenser as claimed in claim 4 wherein the drive roller is a roll support that receives a core of the roll.

14. A toilet paper dispenser as claimed in claim 13 further comprising a sensor for measuring a length of paper dispensed from the roll, the sensor being communicative with the controller.

15. A toilet paper dispenser as claimed in claim 4 wherein the controller is programmed to delay activating the motor until after a selected period of time has elapsed since the last time the motor was activated.

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