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Paper Product Dispenser with Improved Dispensing

Abstract

A dispenser and methods for dispensing web material, the dispenser comprising a dispensing mechanism comprising a pressure roller and a drive roller defining a nip therebetween, wherein the dispensing mechanism is configured to dispense the web material from the roll of web material in response to a user request, and wherein during the dispense a leading edge of the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that the leading edge is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition, the dispensing mechanism is configured to (i) retract the web material to place the leading edge between the nip and the tear bar and (ii) then advance the leading edge past the tear bar.

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Background/Summary

TECHNICAL FIELD

[0001] The present disclosure relates generally to the field of paper product dispensers, and more particularly to electronic paper product dispensers.

BACKGROUND

[0002] Electronic paper product dispensers, including dispensers that automatically dispense a length of paper product in response to sensing the presence of a user, are present in many public washrooms and breakrooms. This type of dispenser has become known as a “hands-free” dispenser in that it is not necessary for the user to manually actuate or otherwise touch the dispenser to initiate a dispense cycle. The control systems and mechanical aspects of conventional hands-free dispensers are wide and varied.

[0003] These types of dispensers can misfeed paper or jam on occasion such that no paper is presented to a user after a dispenser cycle. Once a misfeed or jam has occurred further dispense cycles usually exacerbate the problem putting the dispenser out-of-service until a service attendant can service the dispenser and correct the problem.

SUMMARY OF THE DISCLOSURE

[0004] The present disclosure relates generally to the field of dispensers for dispensing lengths of web material from a roll, and more particularly to electronic dispensers that have improved dispensing operation including paper jam mitigation technology.

[0005] In general, one aspect of the subject matter described in this specification can be implemented in systems that include a dispenser for dispensing web material from a roll of web material, the dispenser comprising a housing comprising a back panel and a front cover and having an internal volume to house the roll of web material; a tear bar at least partially in the housing; a dispensing mechanism, at least partially in the housing, comprising a pressure roller and a drive roller, which define a nip therebetween, wherein the dispensing mechanism is configured to dispense the web material, a dispense length, from the roll of web material in response to a user request, and wherein during the dispense the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that a leading edge of the web material being dispensed is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition, the dispensing mechanism is configured to (i) retract the web material a first length placing the leading edge of the web material between the nip and the tear bar and (ii) then dispense the web material a second length greater than the first length. Other embodiments of this aspect include corresponding methods and apparatus.

[0006] Yet another aspect of the subject matter described in this specification can be implemented in methods that include, in response to detecting a jam condition, driving a motor to rotate a drive roller a second direction to retract a leading edge of a web material to between (i) a nip defined between a pressure roller and the drive roller and (ii) a tear bar; and after the retracting, driving the motor to rotate the drive roller a first direction, different from the second direction, to advance the leading edge away from the nip. Other embodiments of this aspect include corresponding systems and apparatus.

[0007] Yet another aspect of the subject matter described in this specification can be implemented in systems that include a dispenser for dispensing web material from a roll of web material, the dispenser comprising: a dispensing mechanism comprising a pressure roller and a drive roller defining a nip therebetween, wherein the dispensing mechanism is configured to dispense the web

material from the roll of web material in response to a user request, and wherein during the dispense a leading edge of the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that the leading edge is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition, the dispensing mechanism is configured to (i) retract the web material to place the leading edge of the web material between the nip and the tear bar and (ii) then advance the leading edge of the web material past the tear bar. Other embodiments of this aspect include corresponding methods and apparatus.

[0008] Particular embodiments of the subject matter described in this specification can be implemented so as to realize one or more of the following advantages. For example, the dispenser can include a jam sensor that recognizes a jam or misfeed in the dispenser and functionality to try and self-correct the issue without requiring a service attendant to service the dispenser, which can sometimes take hours or days. If the dispenser is able to self-correct the issue then the dispenser remains in an operable condition able to dispense product to users, instead of being out-of-order until serviced by an attendant. This can lead to fewer service calls to service the dispenser, which can reduce the cost associated with operating the dispensers as the service calls can be costly, as well as increasing user satisfaction by reducing the likelihood that a dispenser goes out-of-service due to jams or misfeeds.

[0009] The details of one or more implementations of the subject matter described in this specification are set forth in the accompanying drawings and the description below. Other features, aspects, and advantages of the subject matter will become apparent from the description, the drawings, and the claims.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0010] The disclosure may be more completely understood in consideration of the following detailed description of various embodiments in connection with the accompanying drawings, in which:

[0011] FIG. 1 is a perspective view of a representation an example dispenser;

[0012] FIG. 2A is a perspective view of a representation of the example dispenser of FIG. 1 with the front cover removed;

[0013] FIG. 2B is a perspective view of a representation of the example dispenser of FIG. 2A with the rolls of web material removed;

[0014] FIG. 2C is a perspective view of a representation of the example of FIG. 2B with a side wall removed;

[0015] FIG. 3A is a cross-section view of representation of a portion of a dispensing mechanism of an example dispenser;

[0016] FIG. 3B is a cross-section view of an enhanced representation of a portion of the dispenser of FIG. 3A taken at section 68;

[0017] FIG. 3C is a cross-section view of a representation of a portion of the dispenser of FIG. 3B in a jam condition;

[0018] FIG. 3D is a cross-section view of a representation of a portion of the dispenser of FIG. 3B with the web material retracted; and

[0019] FIG. 3E is a cross-section view of a representation of a portion of the dispenser of FIG. 3B with the web material advanced after it has been retracted.

[0020] While the disclosure is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit aspects of the disclosure to the

particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the disclosure.

[0021] The following description should be read with reference to the drawings in which similar elements in different drawings are numbered the same. The description and the drawings, which are not necessarily to scale, depict illustrative embodiments and are not intended to limit the scope of the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0022] The present disclosure relates generally to the field of dispensers for dispensing lengths of web material from a roll, and more particularly to electronic dispensers that have improved dispensing operation including paper jam reduction/mitigation technology.

[0023] In some implementations, the dispenser includes a dispensing mechanism with a motor that can both advance the product roll (e.g., paper towel roll) to push the tail of the roll out of the dispenser to present the tail to a user to remove, for example, for hand drying, and reverse the product roll to pull the tail of the roll back towards the main body of the roll.

[0024] On occasion, when advancing the roll, the tail may become stuck or otherwise lodged inside the dispenser housing such that a paper jam results preventing the tail from being presented to a user and causing a dispense operation error. To automatically combat this issue (i.e., without the intervention of a service attendant), the dispenser has a jam sensor that can detect this anomaly and trigger a series of steps to try and clear the paper jam. For example, these steps include, in response to a jam condition being detected, the motor reversing to partially wind-up the product roll, to undo the paper jam, and then advancing the product roll a second time in an attempt to properly dispense the product. If the jam sensor senses a paper jam after this second attempt the dispense may repeat this process one or more times, e.g. according to program instructions in the dispenser's firmware, in further attempts to clear the jam. If the jam is cleared then the dispenser can continue normal operation. If the dispenser cannot clear the paper jam through this automated process, then service call from a service attendant may be in order. The dispenser and its operation are more fully described below with reference to the figures.

[0025] Referring particularly to FIGS. **1-2C**, an example dispenser **10** according to the present disclosure is illustrated. FIG. **1** depicts a perspective view of dispenser **10** including a housing **16** of any desired shape and configuration. In some implementations the housing is made from a composite material such as plastic or from a metal material or some combination thereof. The housing **16** can include a base **18** and a cover **22** connected to the base **18** so as to be generally releasably connected together. For example, the cover **22** may be attached to the top or bottom of the base **16** by a hinge such that the cover **22** can pivot away from the base **16** pivoting about the hinge.

[0026] FIG. **2A** depicts a perspective view of the dispenser **10** with the cover **22** removed, while FIG. **2B** depicts the same perspective view as FIG. **2A** with the rolls of web material **12** and **14** removed. FIG. **2C** depicts the same perspective view as FIGS. **2A** and **2B** of the dispenser **10** with the cover **22** removed and also a side wall **34** of the chassis **32** removed to further show internal features of the dispenser **10**. The cover **22** may include a front wall **23** and sidewalls **27** that align with sidewalls **20** of the base **18** to define an interior volume for housing the operational components of the dispenser **10**, as well as the roll or rolls of web material to be dispensed, including a main web material roll **12** and, optionally, a stub web material roll **14**. Any suitable conventional locking mechanism may be provided to secure the cover **22** to the base **18**. The housing **16** includes a bottom underside portion **25** with a throat **24** from which the material is dispensed.

[0027] In some implementations, the operational components of the dispenser **10** may be mounted directly onto the base **18** within the interior volume of the housing **16**. In other implementations, the operational components may be connected together forming a separate removeable module which can be received in the housing **16**. Such a removeable module may be readily removable

from the base **18** for servicing and/or replacing components without the necessity of having to remove the entire dispenser **10** from its support surface (for example, a wall). The housing **16** may be considered as a shell into which the removeable module is inserted and removed.

[0028] Some of the internal components of the dispenser **10** include a frame or chassis **32** having left- and right-side plates **34** and a dispensing mechanism **30**. The dispensing mechanism **30** may include, for example, one or more of the following components: a drive assembly comprising a drive roller **38** and a pressure roller **46**, a transfer mechanism that may include a transfer arm **56**, a throat assembly **50** including a the throat **24**, a tear bar **44**, a drive motor and gear assembly (not visible) that rotates drive roller **38**, a paper jam sensor **53**, and control circuitry **108**. In some implementations, a motor such as that described in U.S. Patent Publication No. 20160353947, filed on Jun. 17, 2016, and titled Dispenser for Rolled Sheet materials with Motorized Spindle,” can be used to rotate the drive roller **38**. The '947 publication is incorporated by reference herein in its entirety for all purposes.

[0029] Left and right main web material roll holders **76** hold the main roll **12**. Stub web material roll holders **78** are provided for rotatably supporting the stub roll **14** in the position within the housing **16**, for example, below and rearward of the main roll **12**. It should be understood that a dispenser according to the present disclosure need not be configured to dispense from a stub roll **14**, and thus would not need a transfer mechanism. The dispenser **10** may be configured for dispensing from a single roll of web material. Additionally, where a stub roll **14** is included, it could be positioned in any suitable position within the housing **16**.

[0030] The cutting or “tear” bar **44** may be disposed along the dispensing path of the web material upstream of the dispensing opening **24** and downstream of the nip **45** (shown in FIG. 3A) between the drive roller **38** and pressure roller **46**. To separate a sheet of the web material that has been dispensed from the dispenser **10**, a user grasps the sheet hanging from beneath the bottom portion **25** of the housing **16** and pulls the sheet against the tear bar **44** such that the sheet tears and separates along the line defined by the tear bar **44**, as the sheet is cut by, for example, serrated edges on the tear bar **44**.

[0031] The pressure roller **46** is spring biased against the drive roller **38** such that the web material passing between the nip **45** of the rollers is advanced along the dispensing path upon rotation of the drive roller **38**, which can be rotated by the motor.

[0032] The dispenser **10** may include an automatic transfer mechanism to transfer dispensing of the web material from the stub roll **14** to a main roll **12** when the web material on the stub roll **14** is nearly fully depleted. From an operational standpoint, this transfer mechanism can operate substantially as described in U.S. Pat. No. 6,079,305 issued on Jun. 27, 2000, with the '305 patent incorporated herein in its entirety for all purposes. Referring to FIGS. 2B and 2C, the transfer mechanism may include a transfer bar **56** with arms pivotally mounted to the housing **18**, or another component of the dispenser **10**. The transfer bar **56** includes a “roller” section that may be defined by a central curved ribbed section **58**. The transfer bar may further include a web retention feature retaining a leading portion of the web material of the main roll **12**.

[0033] The dispenser **10** may be configured to determine an amount of web material which is on the stub roll **14**. For example, the dispenser **10** may include a stub roll sensing bar (not shown) which presses against the stub roll **14**. As the diameter of the stub roll **14** decreases as web material is fed out from the stub roll **14**, the stub roll sensing bar may transmit one or more signals (such as to control circuitry **108**) indicative of the stub roll **14** diameter. Upon detection of a certain stub roll **14** diameter, the dispenser **10** may be configured to rotate the transfer bar **56** such that the leading portion of the web material of the main roll **12** held by the bar **56** is brought by the roller section **58** into contact with the web material being dispensed from the stub roll **14**. This may cause the leading portion of the material of the main roll **12** to be pulled from the arm **56** and conveyed with the web material from the stub roll **14** between the nip **45** of the drive roller **38** and pressure roller **46**. The “new” web material from the main roll **12** is dispensed simultaneously with the stub roll

web material until the stub roll **14** is completely depleted. If no stub roll **14** is present in the dispenser **10**, the transfer bar **56** and roller section **58** contact against the web material dispensed from the main roll **12**. Of course, many other suitable transfer mechanisms may be employed with the dispenser **10** such as is known in the art.

[0034] A “fuel gauge” mechanism (not shown) may be affixed to the one or more components of the dispenser **10** which tracks a remaining amount of web material of the main roll **12** as the web material is depleted. For example, a bar biased against the main roll **12** may track the diameter of the roll **12** to help in determining a remaining amount of web material on the roll **12**. Alternatively, the main roll **12** may be connected to one or more weight sensors which may operate to determine an amount of web material remaining on the main roll **12** by tracking a decreasing weight of the main roll **12**. Upon determining, such as by the control circuitry **108**, that the remaining amount of web material of the main roll **12** is suitable for moving the roll to the stub roll **14** position, the dispenser **10** may cause an alert to be communicated to maintenance personnel that the main roll **12** is depleted and should be replaced. For example, the dispenser **10** may cause an indicator light to turn on which is visible from the exterior of the housing **16**. In other embodiments, the dispenser **10** may, through a transceiver coupled to the control circuitry **108**, send an electronic message (e.g. text, e-mail, or other alert) to an alert receiving device to communicate with maintenance personnel about the status of the main roll **12**.

[0035] A drive motor and gear assembly of the dispensing mechanism **30** may include components such as a drive shaft and a drive gear attached thereto that engages the shaft of the drive roller **38**. In some implementations, upon energizing the motor, the motor causes the drive roller **38** to rotate, which pulls web material of the roll (e.g., roll **12**) because the web material pinched between the pressure roller **46** and drive roller **38** in the nip **45**. From the nip **45**, the web material is conveyed along the dispensing path and out of the dispensing throat **24**.

[0036] The dispensing mechanism **30** may be powered by batteries contained in battery compartment **82**. Any suitable battery storage device or location may be used for this purpose. A conductor may be disposed in contact with the battery compartment **82** for delivering power from the batteries to the control circuitry **108** and the drive motor. Alternatively, or in addition to battery power, the dispenser **10** may also be powered by a building's AC distribution system. For this purpose, a plug-in modular transformer/adaptor may be provided with the dispenser **10**, which connects to a terminal or power jack port for delivering power to the control circuitry **108** and associated components. The control circuitry **108** may include a mechanical or electrical switch that isolates the battery circuit upon connecting the AC adapter in order to protect and preserve the batteries.

[0037] The control circuitry **108** may also control the length of web material dispensed. Any number of optical or mechanical devices may be used in this regard. In some implementations, an encoder **62** may be used to count the revolutions of the drive roller **38** or the motor or the pressure roller **46**, with this count being (stored in the memory of and) used by the control circuitry **108** to meter the desired length of the web material to be dispensed and/or to determine how far to advance and retract the web material during the jam remediation process described below. Other systems may track the running time of the motor as the control variable, or detect perforations in the web material, and so forth.

[0038] The dispenser **10** may utilize one or more user proximity sensors **64** to detect the presence of a user in a first detection zone. In at least some embodiments, the dispenser **10** may utilize one or more further sensors **64** to detect the presence of a user in a second detection zone and, once detected, initiate a dispense sequence. The first detection zone may be oriented in front of the dispenser housing **16**. The second detection zone may be oriented at least partially underneath the dispenser housing **16**.

[0039] Some exemplary sensors **64** may include passive sensors such as photo sensors. Such photo sensors may be any one or combination of conventional photocells that react to changes in ambient

light conditions. The operation of such devices is well known to those skilled in the art and need not be described in detail herein. Other exemplary passive sensing devices may include capacitive sensor systems that detects changes in a capacitive field induced by the presence of a user within the monitored field.

[0040] Other exemplary sensors may include active sensors such as active transmitters and associated receivers that define an active detection zone. This active system may be any one or combination of well-known active sensing systems, such as an RF or IR sensing system. In a particular embodiment where the active sensing system **64** includes an IR transmitter and an IR receiver, the IR transmitter may emit an IR beam into the active detection zone, and the IR receiver may detect IR light reflected from an object in the active detection zone. If the amount of reflected light is sufficient (above a detection threshold value), the control circuitry **108** initiates a dispense cycle wherein a motor drives the drive roller **38** until the predetermined number of pulses (e.g., drive roller **38** revolutions) are detected/counted by the encoder **62** indicating that the correct length of material has been dispensed. The user then grasps the dispensed sheet and pulls it forward to tear the sheet against the tear bar **44**.

[0041] According to some embodiments of the present disclosure, the dispenser **10** may utilize one or more passive sensors **64** and one or more active sensors **64**. Such sensors **64** may be configured to, for each dispense cycle, first sense the presence of a user in the first detection zone with the one or more passive sensors **64**. The presence of a user in the first detection zone may be required before the one or more active sensors **64** are enabled to initiate a dispense sequence upon active detection of the user in the second detection zone. In some implementations, the passive sensor **64** or sensors **64** must reset to a base state indicating the absence of a user in the first detection zone before the active sensor **64** or sensors **64** are enabled for a subsequent dispense sequence. This can minimize or reduce waste of the web material in that it prevents a user from standing in front of the dispenser and initiating multiple sequential dispense operations. The user must exit the area of the first detection zone prior to a subsequent dispense sequence.

[0042] In an alternate embodiment, the control circuitry **108** may define a pre-set time period between dispense sequences. This time period may be adjusted by maintenance personnel. This feature may be in addition to the requirement that the passive sensor **64** or sensors **64** must be reset to a base state. For example, a time period of three seconds may be required after the passive sensor **64** or sensors **64** have been reset.

[0043] In some implementations the passive sensor **64** or sensors **64** need not be reset to a base state, the time period may apply only to sequential activations of the active sensor **64** or sensors **64**. For example, a user may stand in front of the dispenser so that the passive sensor **64** or sensors **64** see a continual “valid” detection. However, the time period must pass between sequential detections of the active sensor **64** or sensors **64**. The time period may be set sufficiently long so as to discourage waste.

[0044] The dispenser **10** may include a “night sensor”, such as an ambient light sensor, configured with the control circuitry **108** as a low-light sensor that shifts the dispenser to a reduced power mode in low-light conditions. In the illustrated embodiment, a photocell may be configured within the dispenser housing **16** to “look” through the housing and above the dispenser housing **16**. The passive sensor **64** or sensors **64** and active sensor **64** or sensors **64** may be disabled by the control circuitry **108** in the low-light conditions. In certain situations, the ambient light detector function may not be desired. For this reason, a bypass switch may be provided and accessible such that maintenance personnel may bypass and deactivate the ambient light-sensing feature.

[0045] The control circuitry **108** may generally control the function of the dispenser **10**. In some embodiments, the control circuitry **108** may be a centralized control unit, for example comprising a processor, ASIC, or microcontroller, specially adapted circuitry configured to act in a control fashion, or the like, and include memory. In such embodiments, the control circuitry **108** may be electrically connected to the various sensors and components of the dispenser **10** and configured to

determine when to dispense web material, and how much, based on received inputs from the components and sensors. In other embodiments, the control circuitry **108** may comprise multiple, separate control units, each of the control units configured to make specific determinations and communicate signals to one or more other controllers. Such multiple control units may act in a coordinated fashion to control the function of the dispenser **10**.

[0046] In some implementations, the dispenser **10** includes a jam sensor **53**. As described above, on occasion, the web material may jam (e.g., bunch up and be prevented from traveling down the dispensing path) or misfeed from roll **12** or **14** during a dispense thereby preventing the tail of the web material (i.e., the loose end of the web material **66**) from exiting the throat **24** to be accessible to a user, which is referred to as a jam condition (shown in FIG. **3C**). The jam sensor **53** can detect this type of jam condition during or after the dispense of the web material from the roll **12** or **14**. In some implementations, the jam sensor **53** is an optical or infrared sensor positioned along the dispensing path, and it can detect the absence or presence of the web material along the path. For example, the jam sensor **53** can be an infrared sensor positioned along the dispensing path, between the tear bar **44** and the throat **24** (as shown in FIG. **3A**), and be configured to sense the presence of web material at the throat **24** as would be expected during a normal dispensing operation. In some implementations, the jam sensor **53** is in communication with the control circuitry **108** such that the control circuitry can read the jam sensor **53** (or receive signals from the jam sensor **53**) to determine whether web material is present. In some implementations, in addition to or alternative a jam sensor **53** in the throat, there may be a jam sensor **53** configured to sense motor current (e.g., a high motor current above a preset threshold indicting a paper jam).

[0047] In some implementations, using the jam sensor **53** to include jam mitigation functionality, the operation of the dispenser **10** is can be described with reference to FIGS. **3B-3E**. FIG. **3B** is a cross-section view of an enhanced representation of a portion of the dispenser of FIG. **3A** taken at section **68**. More particularly, FIG. **3B** shows the web material, after a normal operation dispense, having passed through the nip **45**, the tear bar **44** and (although not shown) out through the throat **24**. During such a normal dispense operation the motor can rotate the drive roller **38** in a first direction (e.g., counterclockwise) to feed out the web material. The control circuitry **108** can monitor the encoder **62** to count revolutions of the drive roller **38** to control how much web material is dispensed. So if the control circuitry **108** is programmed to dispense twelve (12) inches of web material is would cause the motor to rotate the drive roller **38** forty-eight (48) times. In some implementations, the number of motor rotations can be counted and used to determine how much of the web material has been dispensed. Further, for twelve (12) inches of web material to be dispensed there must be twelve (12) inches of web material below the tear bar **44**. At an initial stage (e.g., loading a new roll into the dispenser **10**) the drive roller **38** rotated a number of turns to advance the web material from the nip **45** to the tear bar **44**, denoted as distance “X” in FIG. **3B**.

[0048] To ensure that no jam occurred during the dispense, for example, in response to actuation of the motor or drive roller **38** or a signal from the user proximity sensor **64**, the control circuitry **108** monitors the jam sensor **53** to determine whether the tail of the web material was properly discharged to (and impliedly out of) the throat **24**. If the jam sensor **53** detects the presence of the web material at the throat **53** then the dispenser **10** continues its normal operation.

[0049] However, if the jam sensor **53** does not detect the presence of the web material (e.g., at the throat **24** or another location downstream of the tear bar **44** on the path towards the throat **24**) then the dispenser **10** enters a jam mitigation mode based on the premise that the web material must be jammed or misfed in the dispensing path, as shown in FIG. **3C**, where the web material has, for example, undesirably bunched up and collected behind the tear bar **44** such that it cannot properly fed out through the dispensing path and out the throat **24**. The tear bar **44** is one common component on which the web material can get caught or otherwise have difficulty passing given that it partially protrudes into the dispensing path to facilitate tearing by a user pull, but at the slight expense of being a jam or misfeed point.

[0050] In one implementation, the dispensing mechanism **30**, e.g., through programming in the control circuitry **108**, first causes the motor to rotate the drive roller **38** to dispense an additional length of material to try to push out the jam, which would also be tracked by the encoder **62**. For example, the dispensing mechanism **30** may cause an additional three (3) inches of web material to be dispensed. If the jam sensor **53** still does not detect the presence of the web material then the dispenser **10** continues in the jam mitigation mode.

[0051] The dispensing mechanism **30** then, for example, retracts the web material a first length placing the tail **66** (also referred to as the leading edge) of the web material between the nip **45** and the tear bar **44**. This location, between the nip **45** and the tear bar **44**, is selected, in some implementations, (i) as the tear bar **44** is a likely candidate as a jam or misfeed point as described above so retracting the web material upstream (i.e., closer to the nip **44**) of the tear bar **44** eliminates this potential jam point and (ii) preventing the web material from being retracting upstream of the nip (e.g., before the web material from the roll **12** is fed into the nip) prevents web material from being released from the nip with no automated (i.e., without service attendant assistance) way to reliably re-feed the web material back into the nip **45**) and thus no way to further dispense web material.

[0052] To retract the web material the dispensing mechanism **30** can cause the motor to rotate the drive roller **38** in a second direction (e.g., clockwise) to retract the web material (e.g., wind a portion of the unwound web material back loosely above the nip **45**. In some implementations, the control circuitry **108** determines the first length based on the number of revolutions of the drive roller **38** or motor required to advance the web material to its current length. For example, the distance “X,” the distance between the nip **45** and the tear bar **44**, and/or the number of drive roller **38** or motor revolutions required to advance the web material the distance X, could be specified in the programming of the control circuitry **108**. With this information and accessing the memory storing the encoder data specifying the number of drive roller **38** revolutions to cause the original dispense of, for example, twelve (12) inches and the subsequent three (3) inch unjamming attempt, the control circuitry **108** can determine the first length. For example, if the distance X is one (1) inch, the original dispense twelve (12) inches, the unjamming attempt (3) inches, and one (1) inch of dispensed web material requires four (4) drive roller revolutions, the control circuitry **108** determines that the sixteen inches of dispensed material required sixty-four (64) drive roller **38** revolutions (16 inches×4 revolutions/inch).

[0053] As such, to retract the tail **66** of the web material to between the nip **45** and the tear bar **44** the dispensing mechanism **30** must rotate the drive roller **38** back to the nip **45**, which would be the full (16) sixteen inches, and fifteen (15) inches, which would place the tail **66** at the tear bar **44** as the tear bar **44** is one (1) inch from the nip **45** as determined by the distance X. Thus the dispensing mechanism **30** must rotate the drive roller **38** back between sixty-four (64) (16 inches×4 revolutions/inch) and sixty (60) (15 inches×4 revolutions/inch) revolutions to place the tail **66** between the nip **45** to the tear bar **44**. The first length, then, would be between fifteen (15) and sixteen (16) inches (or sixty (60) and sixty-four (64) drive roller **38** revolutions) in this example. To provide a margin of error, in some implementations, the first length will be selected such that it halves (or otherwise falls in between) the distance between the nip **45** and the tear bar **44**. In this example, that would be fifteen- and one-half inches (15.5) or sixty-two (62) drive roller **38** revolutions. This retraction is illustrated in FIG. 3D, which shows that the bunching in FIG. 3C has been removed.

[0054] In some implementations, in addition to retracting the web material, the dispenser **10** may also cause the tear bar **44** to retract or otherwise move away from the dispensing path to make it easier for the web material to pass by the tear bar **44** when being dispensing. Once the tail **66** of the web material has passed the tear bar **44** the tear bar **44** can move back into its normal position. The functionality of the tear bar **44** to move or retract is described in detail in PCT Application No. PCT/US2019/059151 “ELECTRONIC TOWEL DISPENSER WITH LOW POWER MODE,”

which is incorporated by reference in its entirety herein.

[0055] The dispensing mechanism **30** then (e.g., after the retraction) causes the web material to be dispensed a second length greater than the first length in an attempt to dispense the web material in a normal operation to place the tail **66** of the web material in a position for access by a user, as shown in FIG. **3E**. In some implementations, the dispensing mechanism **30**, after the retraction, is set to cause the web material to be dispensed at least past the tear bar **44** to facilitate determining whether the jam has been cleared, e.g., as determined by whether the jam sensor **53** detects the web material (which can be configured to detect web material just after the tear bar **44** or any other location down the dispensing path towards the throat **24**).

[0056] In some implementations, after a jam or misfeed is detected by the control circuitry **108**, the dispensing mechanism **30** immediately proceeds to retract the web material such that the tail **66** is at a distance from the nip that is no greater than X, i.e., the tail **66** is between the nip **45** and the tear bar **44**. In this implementation, there is no initial effort (i.e., before the retraction) to further advance the web material to “push out” the jam as described above.

[0057] All documents cited in the Detailed Description are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention. To the extent that any meaning or definition of a term in this written document conflicts with any meaning or definition of the term in a document incorporated by references, the meaning or definition assigned to the term in this written document shall govern.

[0058] Those skilled in the art will recognize that the present disclosure may be manifested in a variety of forms other than the specific embodiments described and contemplated herein.

Specifically, the various features described with respect to the various embodiments and figures should not be construed to be applicable to only those embodiments and/or figures. Rather, each described feature may be combined with any other feature in various contemplated embodiments, either with or without any of the other features described in conjunction with those features.

Accordingly, departure in form and detail may be made without departing from the scope of the present disclosure as described in the appended claims.

EMBODIMENTS

[0059] Embodiment 1: A dispenser for dispensing web material from a roll of web material, the dispenser comprising: a housing comprising a back panel and a front cover and having an internal volume to house the roll of web material; a tear bar at least partially in the housing; a dispensing mechanism, at least partially in the housing, comprising a pressure roller and a drive roller, which define a nip therebetween, wherein the dispensing mechanism is configured to dispense the web material, a dispense length, from the roll of web material in response to a user request, and wherein during the dispense the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that a leading edge of the web material being dispensed is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition, the dispensing mechanism is configured to (i) retract the web material to place the leading edge of the web material between the nip and the tear bar and (ii) then dispense the web material to place the web material past the tear bar.

[0060] Embodiment 2: The towel dispenser of embodiment 1, wherein the dispensing mechanism comprises a motor engaged to the drive roller and configured to rotate the drive roller in a first direction in response to the user request and to rotate the drive roller in a second direction, different from the first direction, to retract the web material. [0061] Embodiment 3: The towel dispenser of embodiment 2, comprising an encoder configured to count a number of revolutions of one of the motor and the drive roller to dispense the web material the dispense length. [0062] Embodiment 4: The towel dispenser of embodiment 3, wherein retract the web material a first length comprises rotate the drive roller in the second direction based on the number of revolutions counted to dispense the dispense length. [0063] Embodiment 5: The towel dispenser of any of embodiments 2-4, wherein the jam sensor comprises an infrared sensor. [0064]

Embodiment 6: The towel dispenser of any of the embodiments 1-5, wherein the second length is equal to the dispense length. [0065] Embodiment 7: The towel dispenser of any of the embodiments 1-6, wherein the roll of web material is a roll of paper towels. [0066] Embodiment 8: A method comprising: in response to detecting a jam condition, driving a motor to rotate a drive roller a second direction to retract a leading edge of a web material to between (i) a nip defined between a pressure roller and the drive roller and (ii) a tear bar; and after the retracting, driving the motor to rotate the drive roller a first direction, different from the second direction, to advance the leading edge away from the nip. [0067] Embodiment 9: The method of embodiment 8, wherein detecting a jam condition comprising monitoring for a presence of web material in a throat of the dispenser. [0068] Embodiment 10: The method of embodiment 9, wherein detecting the jam condition comprises determining that the web material is not in the throat. [0069] Embodiment 11: The method of any of embodiments 8-10, wherein driving a motor to rotate a drive roller a second direction comprises counting at least one of a number of motor revolutions and drive roller revolutions. [0070] Embodiment 12: The method of any of embodiments 8-11, wherein driving the motor to rotate the drive roller a first direction comprises driving the drive roller to place the leading edge past the tear bar. [0071] Embodiment 13: The method of any of embodiments 8-12, wherein driving a motor to rotate a drive roller a second direction and driving the motor to rotate the drive roller a first direction repeats multiple times. [0072] Embodiment 14: A dispenser for dispensing web material from a roll of web material, the dispenser comprising: a dispensing mechanism comprising a pressure roller and a drive roller defining a nip therebetween, wherein the dispensing mechanism is configured to dispense the web material from the roll of web material in response to a user request, and wherein during the dispense a leading edge of the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that the leading edge is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition, the dispensing mechanism is configured to (i) retract the web material to place the leading edge of the web material between the nip and the tear bar and (ii) then advance the leading edge of the web material past the tear bar. [0073] Embodiment 15: The dispenser of embodiment 14, wherein the dispensing mechanism comprises a motor engaged to the drive roller and configured to rotate the drive roller in a first direction in response to the user request and to rotate the drive roller in a second direction, different from the first direction, to retract the web material. [0074] Embodiment 16: The dispenser of embodiment 15 comprising an encoder configured to count a number of revolutions of one of the motor and the drive roller to dispense the web material. [0075] Embodiment 17: The dispenser of embodiment 16, wherein retract the web material comprises rotate the drive roller in the second direction based on the number of revolutions counted to dispense the web material. [0076] Embodiment 18: The dispenser of any of embodiments 15-17, wherein the jam sensor comprises an infrared sensor. [0077] Embodiment 19: The dispenser of any of embodiments 15-18, wherein the roll of web material is a roll of paper towels. [0078] Embodiment 20: The dispenser of any of embodiments 15-19 comprising a user proximity sensor configured to actuate the dispensing mechanism in response to an object entering a field of sensing of the user proximity sensor. [0079] Embodiment 21: A dispenser for dispensing web material from a roll of web material, the dispenser comprising: a dispensing mechanism comprising a pressure roller and a drive roller defining a nip therebetween, wherein the dispensing mechanism is configured to dispense the web material from the roll of web material by rotating the drive roller in response to a user request, and wherein during the dispense a leading edge of the web material being dispensed first passes through the nip and then passes the tear bar and then out of the housing such that the leading edge is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to a jam condition: [0080] the dispensing mechanism is configured to rotate the drive roller a specified number of revolutions in an attempt to advance the leading edge of the web material; and [0081] in

response to determining a jam condition still exists, the dispensing mechanism is configured to (i) retract the web material to place the leading edge of the web material between the nip and the tear bar and (iii) then advance the leading edge of the web material past the tear bar. [0082]

Embodiment 22. The dispenser of embodiment 21 wherein a specified number of revolutions is less than a number of revolutions to dispense the web material from the roll of web material in response to the user request. [0083]

Embodiment 23. A method comprising: in response to detecting a jam condition, driving a motor to rotate a drive roller a second direction to retract a leading edge of a web material to between (i) a nip defined between a pressure roller and the drive roller and (ii) a tear bar; and after the retracting, driving the motor to rotate the drive roller a first direction, different from the second direction, to advance the leading edge away from the nip. [0084]

Embodiment 24. The method of embodiment 23 comprising in response to detecting the jam condition and prior to the retracting, driving the motor to rotate the drive roller the first direction and then determining if a jam condition still exists. [0085]

When introducing elements of the present disclosure or the preferred embodiment(s) thereof, the articles “a”, “an”, “the” and “said” are intended to mean that there are one or more of the elements. The terms “comprising”, “including” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements. While this specification contains many specific implementation details, these should not be construed as limitations on the scope of any invention or of what may be claimed, but rather as descriptions of features that may be specific to particular embodiments of particular inventions. Certain features that are described in this specification in the context of separate embodiments can also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment can also be implemented in multiple embodiments separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

Claims

1.-20. (canceled)

21. A dispenser for dispensing web material from a roll of web material, the dispenser comprising: a housing comprising a back panel and a front cover and having an internal volume to house the roll of web material; a tear bar at least partially in the housing; a dispensing mechanism, at least partially in the housing, configured to dispense the web material, a dispense length, from the roll of web material, and wherein during the dispense the web material being dispensed unwinds from the roll and then passes the tear bar and then out of the housing such that a leading edge of the web material being dispensed is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to the jam condition, the dispensing mechanism is configured to (i) retract the web material to a position before the tear bar and (ii) then dispense the web material to place the web material past the tear bar.

22. The dispenser of claim 21, wherein the dispensing mechanism comprises a motor engaged to a drive roller and configured to rotate the drive roller in a first direction and to rotate the drive roller in a second direction, different from the first direction, to retract the web material.

23. The dispenser of claim 22 comprising an encoder configured to count a number of revolutions of one of the motor and the drive roller to dispense the web material the dispense length.

24. The dispenser of claim 23, wherein retract the web material comprises rotate the drive roller in the second direction based on the number of revolutions counted to dispense the dispense length.

25. The dispenser of claim 22, wherein the jam sensor comprises an infrared sensor.

- 26.** The dispenser of claim 21, wherein dispense the web material to place the web material past the tear bar comprises dispense the web material the dispense length.
- 27.** The dispenser of claim 21, wherein the roll of web material is a roll of paper towels.
- 28.** A method for clearing a jam from a dispenser, the method comprising: in response to detecting a jam condition, driving a motor to rotate a drive roller a second direction to retract a leading edge of a web material to a position before a tear bar; and after the retracting, driving the motor to rotate the drive roller a first direction, different from the second direction, to advance the leading edge past the tear bar.
- 29.** The method of claim 28, wherein detecting the jam condition comprises monitoring for a presence of web material in a throat of the dispenser.
- 30.** The method of claim 29, wherein detecting the jam condition comprises determining that the web material is not in the throat.
- 31.** The method of claim 28, wherein driving a motor to rotate a drive roller a second direction comprises counting at least one of a number of motor revolutions and drive roller revolutions.
- 32.** The method of claim 28, wherein driving the motor to rotate the drive roller a second direction comprises retracting the leading edge for a specified distance.
- 33.** The method of claim 28, wherein driving a motor to rotate a drive roller a second direction and driving the motor to rotate the drive roller a first direction repeats multiple times.
- 34.** A dispenser for dispensing web material from a roll of web material, the dispenser comprising: a dispensing mechanism configured to dispense the web material from the roll of web material, and wherein during the dispense a leading edge of the web material being dispensed unwinds from the roll and then passes a tear bar and then out of a housing of the dispenser such that the leading edge is external to the housing; a jam sensor configured to detect a jam condition during or after the dispense of the web material; and wherein, in response to the jam condition, the dispensing mechanism is configured to (i) retract the web material to a position before the tear bar and (ii) then dispense the web material to place the web material past the tear bar.
- 35.** The dispenser of claim 34, wherein the dispensing mechanism comprises a motor engaged to a drive roller and configured to rotate the drive roller in a first direction and to rotate the drive roller in a second direction, different from the first direction, to retract the web material.
- 36.** The dispenser of claim 35 comprising an encoder configured to count a number of revolutions of one of the motor and the drive roller to dispense the web material.
- 37.** The dispenser of claim 36, wherein retract the web material comprises rotate the drive roller in the second direction based on the number of revolutions counted to dispense the web material.
- 38.** The dispenser of claim 35, wherein the jam sensor comprises an infrared sensor.
- 39.** The dispenser of claim 34, wherein the roll of web material is a roll of paper towels.
- 40.** The dispenser of claim 34 comprising a user proximity sensor configured to actuate the dispensing mechanism in response to an object entering a field of sensing of the user proximity sensor.
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