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(54) ANTI-THEFT PUSHER WITH INCREMENTAL DISTANCE DETECTION

(57) A retail merchandise pusher is configured for sliding along a pusher assembly track. The pusher assembly is mountable to a retail merchandise shelf. The pusher includes a housing, a spring drum rotatably mounted within the housing, and a coil spring mounted to the spring drum. The coil spring is coilable and uncoilable upon rotation of the spring drum. A controller is coupled to a sensor arrangement within the housing. The sensor arrangement has a spring drum sensor for detecting rotation of the spring drum. A direction sensor detects a direction of rotation of the spring drum. An incremental distance sensor detects incremental movement of the pusher. The controller is configured to calculate, based on data from the sensor arrangement, a total distance and direction of travel by the pusher, and to generate an alarm when the pusher travels more than a threshold distance within a predetermined period of time.

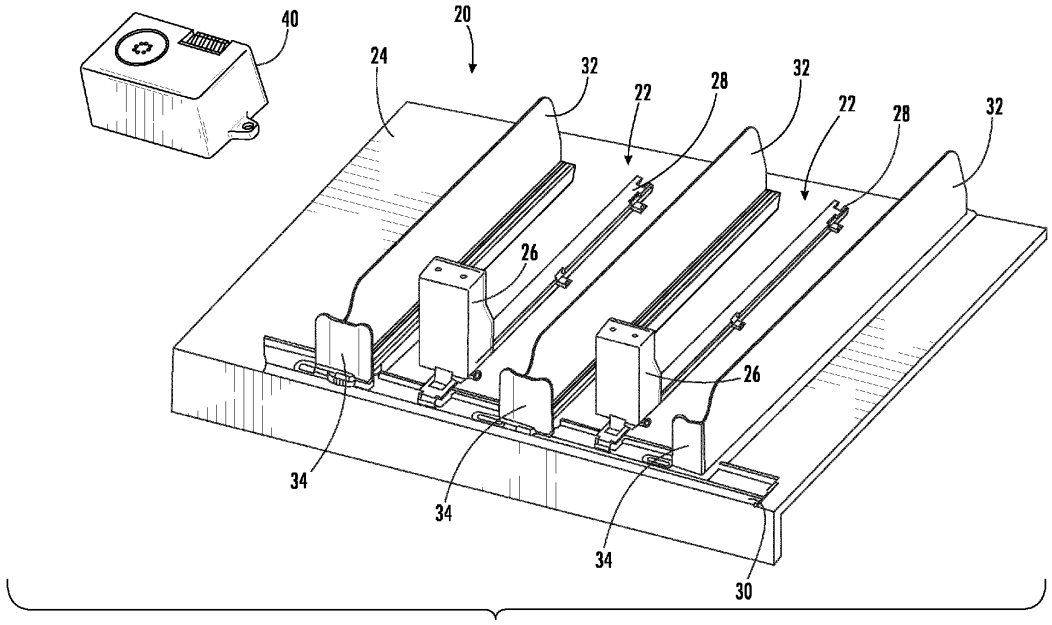

FIG. 1

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Description

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This patent application is a Continuation-in-Part of co-pending U.S. Patent Application No. 17/727,496, filed April 22, 2022, which is a Continuation of U.S. Patent Application No. 16/839,667, filed April 3, 2020, and issued as U.S. Patent No. 11,363,894, which claims the benefit of U.S. Provisional Patent Application No. 62/830,045, filed April 5, 2019, the entire teachings and disclosures of which are incorporated herein by reference thereto. This patent application is also a Continuation-in-Part of co-pending U.S. Patent Application No. 17/697,538, filed March 17, 2022, which is a Continuation of U.S. Patent Application No. 17/220,424, filed April 1, 2021, and issued as U.S. Patent No. 11,317,738, which is a Continuation of U.S. Patent Application No. 16/295,056, filed March 7, 2019, and issued as U.S. Patent No. 10,993,550, which claims the benefit of U.S. Provisional Patent Application No. 62/646,115, file March 21, 2018, the entire teachings and disclosures of which are incorporated herein by reference thereto.

FIELD OF THE INVENTION

[0002] This invention generally relates to a retail merchandise pusher, and more particularly to a self-facing retail merchandise pusher incorporating anti-theft and inventory management technologies.

BACKGROUND OF THE INVENTION

[0003] Self-facing retail merchandise displays are generally known in the art. Once such typical display includes one or more pusher assemblies which may for example be situated on a retail merchandise shelf. A conventional pusher assembly incorporates a pusher that rides along an elongated track. The track may be a single drop in track with a single pusher slidable thereon, or it may be a structure defining multiple tracks for receipt of respective pushers. A spring is connected between the pusher and a leading edge of the track. The spring acts to bias the pusher forward along the track towards the leading edge thereof. A given display may utilize multiple pusher assemblies arranged generally in parallel to on another.

[0004] A user can retract the pusher away from the leading edge of the track and position items of retail merchandise (also referred to herein as products) in a linear row on top of the track and uncoiled portion of the spring, between the leading edge of the track and the pusher. The biasing force provided by the spring and exerted upon the pusher serves to bias the linear row of retail merchandise forward to ultimately "front face" the merchandise.

[0005] That is, when a customer removes the leading most item of merchandise from the linear row of merchandise, the pusher will be drawn forward by the spring to index the row of merchandise forward so that the next item of merchandise in the row is positioned proximate the leading edge of the track in an aesthetically pleasing manner. Such automatic front facing eliminates the necessity for retail store employees to manually face the merchandise, and thus ultimately reduces the cost of labor of the retailer.

[0006] The aforementioned pusher systems have been utilized in various retail display environments. One example is a retail shelf. Typically, a plurality of pusher bodies and their corresponding tracks are arranged in a side-by-side manner along the shelf. Each pusher and its corresponding track are separated by dividers to maintain a plurality of generally straight rows of merchandise that run from the front to the back of the shelf. Such a familiar configuration can be found in many retail stores for selling hygiene items such as deodorant, as one example.

[0007] In another configuration, the pusher system may be embodied as a stand-alone pusher tray. These trays may include means for mounting the tray as a cantilevered extension from another structure, such as a bar. These trays may also be situated directly on a retail shelf. Further, these trays may include side barriers which are adjustable so as to accommodate merchandise of differing widths. Examples of these trays may be readily seen at U.S. Patent Nos. 9,254,049, 9,241,583, 8,720,702, each of which is incorporated by reference herein in its entirety.

[0008] Loss prevention is a continuing problem in the retail industry. Current anti-theft systems involve locking up merchandise behind counters that are far away from other related merchandise, or locking up the merchandise in secure cabinets that are closer to where the related merchandise is generally stored.

[0009] Heretofore, there have been limited attempts at incorporating anti-theft technology into pusher systems themselves. Such attempts, while sufficient for a majority of loss prevention scenarios may not detect very small movements of the pusher, e.g., where very small merchandise is contained in the pusher system such that removal of one item or even several creates a very small movement in the pusher.

[0010] Other challenges arise in self-facing retail merchandise displays with regard to inventory management. Because the merchandise contained in such displays is typically high purchase volume merchandise, e.g., deodorants, razor blades, medicines, etc., it is not uncommon for one or more rows of the display to become completely empty for some time before being restocked. Accordingly, such displays must be routinely inspected by store personnel to ensure that they have adequate stock levels. This inspection may be overlooked from time to time in the event the store is understaffed, or adequately staffed but very busy. Such manual inspection, while necessary, diverts store personnel from other potentially more pressing activities such as customer service.

[0011] Accordingly, there exists a need in the art for a retail merchandise pusher display, pusher assembly, and pusher incorporating a system for retail stores that will deter theft and enhance inventory management of such displays.

BRIEF SUMMARY OF THE INVENTION

[0012] In one aspect, embodiments of the invention provide a retail merchandise pusher configured for sliding along a track of a pusher assembly, where the pusher assembly is mountable to a retail merchandise shelf. The pusher includes a housing, a spring drum rotatably mounted within the housing, and a coil spring mounted to the spring drum. The coil spring is coilable and uncoilable upon rotation of the spring drum. A controller is coupled to a sensor arrangement carried within the housing. The sensor arrangement includes a spring drum sensor for detecting rotation of the spring drum. A direction sensor detects a direction of rotation of the spring drum, while an incremental distance sensor detects an incremental movement of the pusher. The controller is configured to calculate, based on data from the sensor arrangement, a total distance and direction of travel by the pusher, and also configured to generate an alarm when the pusher travels more than a threshold distance within a predetermined period of time.

[0013] In a particular embodiment, the alarm is at least one of a visual, audible, or RF signal. The controller may be coupled to an output device disposed in the housing, where the output device is configured to produce the alarm as a visual or audible signal. Furthermore, the controller may be coupled to a transmitter disposed in the housing, where the transmitter is configured to wirelessly transmit data to a remote receiver. The aforementioned data includes at least one of an alarm status, and the total distance and direction of travel by the pusher.

[0014] In particular embodiments, the controller is configured to transmit information, based on data from the sensor arrangement, wherein the information includes an inventory status for the pusher assembly. As used in this application, the term "inventory status" or "stock status" relates to the number of merchandise items remaining in a particular pusher assembly. The movement of the pusher, which may indicate either the replenishment or the removal of goods from the pusher assembly, typically results in a change of the inventory status for the pusher assembly. In more particular embodiments, the controller comprises a microprocessor.

[0015] In some embodiments, the spring drum sensor includes a pair of opposed electrical contacts and a tab extending from the spring drum, the tab rotatable with the spring drum, wherein the tab is arranged to bias one of the pair of opposed electrical contacts into contact with the other one of the pair of the opposed electrical contacts at each complete revolution of the spring drum.

[0016] In other embodiments, the direction sensor includes a first electrical contact, a common electrical contact, and a second electrical contact, the common electrical contact interposed between the first electrical contact and the second electrical contact. In a further embodiment, a distal end of common electrical contact is intermittently in contact with gear teeth formed on an outer periphery of the spring drum such that the common electrical contact is biased by the gear teeth into contact with the first electrical contact when the spring drum rotates in a first direction, and biased by the gear teeth into contact with the second electrical contact when the spring drum rotates in a second rotational direction opposite the first rotational direction.

[0017] In certain embodiments, the incremental distance sensor includes a sensing gear in contact with the spring drum, and a slotted disc mounted to the sensing gear, the incremental distance sensor further comprising a light sensor arrangement configured to produce and detect a beam of light. In a further embodiment, a peripheral region of the slotted disc is movable through a sensing region through which the beam of light extends, wherein the peripheral region includes a plurality of slots formed therein, wherein the plurality of slots sequentially pass through the sensing region as the sensing gear rotates such that the beam of light alternately passes through and is blocked by the plurality of slots. The light sensor arrangement may include a light emitter located on a first side of the slotted disc, and a light sensor located on a second side of the slotted disc opposite the first side, the light sensor arranged to detect the beam of light emitted by the light emitter.

[0018] In more particular embodiments, the light emitter is arranged to emit the beam of light such that it is perpendicular to a plane of rotation defined by the slotted disc. In other embodiments, the coil spring is configured to bias the housing toward one end of the track. Further, the pusher may be configured to permit a user to set or adjust at least one of the threshold distance and the predetermined period of time. In some embodiments, the pusher includes a reset control to set a zero position for the controller, the zero position indicating that no merchandise is contained in the pusher assembly such that the pusher is at an end of the track.

[0019] In another aspect, embodiments of the invention provide a pusher assembly configured for mounting to a retail shelf, the shelf having a front and a back, wherein retail merchandise situated near the front of the shelf is removable from the pusher assembly. The pusher assembly includes a track, and a pusher mounted to the track. The pusher is slidable toward and away from the front of the shelf. The pusher includes a controller coupled to a sensor arrangement for detecting movement and a direction of travel by the pusher. The controller is configured to calculate, based on data from the sensor arrangement, a total distance traveled by the pusher along the track. The controller is further configured to generate an alarm when the pusher travels more than a threshold distance within a predetermined period of time.

[0020] In a particular embodiment, the sensor arrange-

ment includes a spring drum sensor, a direction sensor, and an incremental distance sensor. In one embodiment, the spring drum sensor includes a pair of opposed electrical contacts and a tab extending from a rotatable spring drum of the pusher, the tab rotatable with the spring drum, wherein the tab is arranged to bias one of the pair of opposed electrical contacts into contact with the other one of the pair of the opposed electrical contacts at each complete revolution of the spring drum.

[0021] In another embodiment, the direction sensor includes a first electrical contact, a common electrical contact, and a second electrical contact, the common electrical contact interposed between the first electrical contact and the second electrical contact. The incremental distance sensor may include a sensing gear in contact with the spring drum the gear including a slotted disc mounted to the gear, the incremental distance sensor further comprising a light sensor arrangement configured to produce and detect a beam of light.

[0022] In certain embodiments, the alarm is at least one of a visual, audible, or RF signal, and the controller is coupled to a transmitter configured to wirelessly transmit data to a remote receiver. The aforementioned data includes at least one of an alarm status, and the total distance and direction of travel by the pusher. The pusher may be further configured to permit a user to set or adjust at least one of the threshold distance and the predetermined period of time, and to include a reset control to set a zero position for the controller. The zero position indicates that no merchandise is contained in the pusher assembly such that the pusher is at an end of the track. The controller may be configured to provide, based on data from the sensor arrangement, an inventory status of the pusher assembly.

[0023] In yet another aspect, embodiments of the invention provide a retail merchandise display system for self-facing retail merchandise. The retail merchandise display includes a shelf, and at least one pusher assembly mounted to the shelf. The at least one pusher assembly includes a track, and a pusher slidable along the track. The pusher assembly includes a controller coupled to a sensor arrangement. The controller is configured to calculate, based on data from the sensor arrangement, a large-scale movement of the pusher, and an incremental movement by the pusher, where the controller is configured to generate a local alarm when a total distance traveled by the pusher, where the total distance is equal to a sum of the large-scale movement and the incremental movement, is greater or equal to a predefined distance. The pusher includes a transmitter operable to wirelessly communicate the total distance traveled by the pusher. A receiver is remotely located from the pusher, and configured to receive a wireless signal from the transmitter, and configured to generate a remote alarm in concert with the local alarm.

[0024] In certain embodiments, the local and remote alarms are at least one of visual or audible alarms. In other embodiments, the at least one pusher assembly includes a plurality of pusher assemblies, wherein each one of the plurality of pusher assemblies wirelessly communicate with the receiver. Still, in other embodiments, the receiver includes an RF receiver, an audio speaker, and a Wi-Fi module configured to transmit data received from the pusher. Further, the wireless signal may be an RF signal. As used herein, the term "wireless signal" means any type of wireless signals which broadly speaking may be AM signals, FM signals, microwave signals, any combination thereof, or any other suitable type of wireless signal, using any known communication protocol including, but not limited to, Wi-Fi, Bluetooth, Zigbee, Z-wave, DigiMesh, 6LowPan, Thread, WirelessHart, Dash7, Weightless, ANT, Ingenu, LoRaWan, any of the various cellular protocols, conventional radio, etc. This same definition of a wireless signal applies to any signals described explicitly, inherently, or implicitly as being sent wirelessly. The pusher controller, receiver, and upper-level system controller may be configured to use any one or more of the aforementioned communications protocols.

[0025] In some embodiments, the sensor arrangement includes a spring drum sensor, a direction sensor, and an incremental distance sensor. Further, the receiver may be configured to transmit data received from the pusher to a computer or mobile device, such that the data allows the computer or mobile device to display information regarding the pusher assembly. Moreover, the information regarding the pusher assembly may include at least one of an alarm status, and inventory status, and a position of the pusher.

[0026] In certain aspects, embodiments of the invention provide a retail merchandise pusher system that includes a pusher assembly having a pusher configured to slide along a track of the pusher assembly. The pusher assembly is mountable to a retail merchandise shelf. The pusher has a housing, a spring drum rotatably mounted within the housing, and a coil spring mounted to the spring drum. The coil spring is coilable and uncoilable upon rotation of the spring drum. A pusher controller is coupled to a sensor arrangement carried within the housing. The sensor arrangement includes a spring drum sensor for detecting rotation of the spring drum, a direction sensor for detecting a direction of rotation of the spring drum, and an incremental distance sensor for detecting an incremental movement of the pusher. The pusher controller is configured to calculate, based on data from the sensor arrangement, a number of retail items in the track, and to wirelessly transmit inventory data indicative of the number of retail items in the track.

[0027] In particular embodiments, the pusher controller is further configured to transmit a unique identifier for the pusher assembly. Additionally, the pusher assembly may include a UPC reader or QR code scanner to automatically scan a UPC or QR code on each retail item. In some embodiments, the retail merchandise pusher system includes a receiver, located remotely from the pusher assembler, where the receiver is configured to receive

the inventory data and to transmit the inventory data to an upper-level system controller.

[0028] In a further embodiment, the receiver is configured to transmit, along with the inventory data, a unique identifier for the receiver. In more particular embodiments, the receiver includes an external antenna, and can receive data from a pusher located 200 feet from the receiver. In certain embodiments, the pusher controller calculates the number of retail items in the track based on a position of the pusher and on a size of the retail item. Furthermore, the pusher controller may be configured to repeat each wireless transmission of inventory data at least once.

[0029] In particular embodiments, an upper-level system controller is configured to receive the inventory data, and to transmit the inventory data to a networked computer server. The upper-level system controller may be configured to transmit, along with the inventory data, a unique identifier for the upper-level system controller. Furthermore, the upper-level system controller may be configured to receive data from the computer server. In a particular embodiment, the data received from the computer server includes a software update. The retail merchandise pusher system includes an embodiment where the upper-level system controller is configured to communicate directly with the pusher controller. Additionally, the upper-level system controller may include one or more visual indicators configured to indicate whether the upper-level system controller is receiving power, or transmitting data, or receiving data.

[0030] In a further embodiment, the pusher assembly includes an RFID reader to automatically scan an RFID device on each retail item. Embodiments of the retail merchandise pusher system also include a networked computer server configured to receive and aggregate the inventory data transmitted by the pusher controller. In some embodiments, the inventory data is transmitted from the pusher controller to an upper-level system controller which then transmits the inventory data to the computer server. In particular embodiments, the pusher controller is configured to transmit the inventory data to an upper-level controller, which is configured to transmit the inventory data via a network link to the computer server. Communication via the network link includes communication via the internet, or via an intranet, or via an extranet.

[0031] In yet another aspect, embodiments of the invention provide a retail inventory management system that includes the retail merchandise pusher system described above. Further, a computer server is configured to receive and aggregate the inventory data transmitted by the pusher controller. The computer server is linked to a network and further configured to send the inventory data to a display of a client device. The computer server is configured to transmit inventory data to the display, in real-time, such that the display shows the inventory data from a plurality of pusher assemblies. In embodiments of the retail inventory management system, the computer server causes the display to show the inventory data both graphically and textually.

[0032] In a particular embodiment, the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in each pusher assembly on one or more shelves in a particular store. In other embodiments, the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in one or more pusher assemblies in a particular store. Furthermore, the computer server may be configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for a particular SKU, disposed in the one or more pusher assemblies in each store of a plurality of stores. In some embodiments, the computer server is configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in one or more pusher assemblies in a particular store. However, the computer server may also be configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in the one or more pusher assemblies in each store of a plurality of stores.

[0033] In certain embodiments, the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of backstock items for the particular SKU in the particular store. However, the computer server may also be configured to transmit inventory data to the display, in real-time, indicating the number of backstock items for every SKU in each store of a plurality of stores. Further still, the computer server may be configured to automatically prompting a user to restock the one or more pusher assemblies using backstock items for one or more SKUs in one or more of the plurality of stores.

[0034] In some embodiments, the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of each retail item, for an entire department or category of retail items, disposed in one or more pusher assemblies in a particular store. In other embodiments, the computer server is configured to transmit inventory data to the display, in real-time, indicating the number of each retail item, for the entire department or category of retail items, disposed in the one or more pusher assemblies in each store of a plurality of stores.

[0035] Additionally, the computer server may be configured to transmit inventory data to the display, in real-time, indicating a number of SKUs which are out-of-stock at a particular store. In a further embodiment, the computer server is configured to transmit inventory data to the display, in real-time, indicating each store of a plurality of stores where at least one SKU is out-of-stock. In more particular embodiments, the computer server is configured to automatically generate a purchase order for an out-of-stock SKU, or to automatically generate an alert prompting a user to create the purchase order.

[0036] In a particular embodiment, the computer server is configured to calculate and transmit inventory data to the display indicating a rate of inventory usage for one or more SKUs, or for one or more stores. Additionally, the computer server may be configured to calculate and transmit inventory data to the display indicating a rate of inventory usage by hour of the day, day of the week, week of the month, or month of the year. Furthermore, the computer server may be configured to analyze trends in the rate of inventory usage in order to determine when inventory at a particular store is to be replenished.

[0037] The computer server nay also be configured to transmit inventory data, simultaneously and in real-time, to a plurality of displays located locally or remotely from the computer server. In a further embodiment, the computer server is configured with multiple levels of access for users, wherein each access level has different privileges associated therewith. In some embodiments of the retail inventory management system, the client device is one of a desktop computer, a laptop computer, a notebook computer, a tablet computer, a smartphone, or a smartwatch.

[0038] In still another aspect, embodiments of the invention provide a retail merchandise display system that includes a pusher assembly having a pusher configured to slide along a track of the pusher assembly. The pusher includes a housing, and a sensor arrangement carried with the housing. The sensor arrangement is configured to detect a direction of movement of the pusher and a distance of travel of the pusher. A controller is configured to calculate, based on data from the sensor arrangement, a number of retail items in the track.

[0039] In a particular embodiment, the sensor arrangement includes a direction sensor for detecting a direction of rotation of the spring drum indicative of a direction of movement of the housing and an incremental distance sensor for detecting incremental movement of the housing. In a more particular embodiment, the pusher includes a spring drum rotatably mounted to the housing, and a coil spring mounted to the spring drum, where the coil spring is coilable and uncoilable upon rotation of the spring drum.

[0040] In a further embodiment, the retail merchandise display system has a user interface configured to display an amount of inventory stored in the pusher assembly. The sensor arrangement may be configured to sense large-scale movement of the pusher and incremental movement of the pusher, while the controller may be configured to determine a change in inventory stored in the pusher assembly based on a total distance traveled by the pusher, where the total distance is equal to a sum of the large-scale movement and the incremental movement, and the change in inventory stored in the pusher is the total distance traveled by the pusher, divided by a product depth value of each retail item measured parallel to an axis of travel of the pusher along the track.

[0041] Embodiments of the retail merchandise display system further include a transmitter that wirelessly sends the distance of travel and direction of movement information. In some embodiments, the controller is configured to determine a change in inventory stored in the pusher assembly by dividing a total distance traveled by the pusher by a product depth of each retail item measured parallel to an axis of travel of the pusher along the track. Furthermore, the controller may also determine if the change is an increase in displayed inventory or a decrease in displayed inventory based on the direction of travel information sensed by the sensor arrangement.

[0042] The controller may also be configured to determine the product depth by receiving distance of travel information from a zero position from the sensor assembly sensed upon insertion of a predetermined number of retail items and then dividing the distance of travel information by the predetermined number of retail items. Additionally, the predetermined number of retail items may be greater than or equal to one retail item. In certain embodiments, the controller calculates the number of retail items in the track based on a position of the pusher and on a size of the retail item. In other embodiments, the position of the pusher is determined based on a distance traveled information and the direction of travel information after the system has been zeroed.

[0043] In a particular embodiment, the controller calculates the number of retail items in the track based on an initial number of items manually input into the system and changes in the number of items based on the distance traveled information and the direction of travel information sensed after the initial number of items is input into the system. In a further embodiment, the initial number of items is manually input into the system using a user interface remote from the pusher.

[0044] The solutions in accordance with the present invention comprise, in particular, the combinations of features defined by the following embodiments numbered consecutively.

1. A retail merchandise pusher system comprising: a pusher assembly having a pusher configured to slide along a track of the pusher assembly, the pusher assembly being mountable to a retail merchandise shelf, the pusher comprising: a housing; a spring drum rotatably mounted within the housing; a coil spring mounted to the spring drum, the coil spring coilable and uncoilable upon rotation of the spring drum; and a pusher controller coupled to a sensor arrangement carried within the housing, the sensor arrangement comprising: a spring drum sensor for detecting rotation of the spring drum; a direction sensor for detecting a direction of rotation of the spring drum; and an incremental distance sensor for detecting an incremental movement of the pusher; wherein the pusher controller is configured to calculate, based on data from the sensor arrangement, a number of retail items in the track, and to wirelessly transmit inventory data indicative of the number of retail items in the track.

2. The retail merchandise pusher system of embodiment 1, wherein the pusher controller is further configured to transmit a unique identifier for the pusher assembly.

3. The retail merchandise pusher system of embodiment 1, wherein the pusher assembly includes a UPC reader or QR code scanner to automatically scan a UPC or QR code on each retail item.

4. The retail merchandise pusher system of embodiment 1, further comprising a receiver, located remotely from the pusher assembler, the receiver configured to receive the inventory data and to transmit the inventory data to an upper-level system controller.

5. The retail merchandise pusher system of embodiment 4, wherein the receiver is configured to transmit, along with the inventory data, a unique identifier for the receiver.

6. The retail merchandise pusher system of embodiment 4, wherein the receiver includes an external antenna, and wherein the receiver can receive data from a pusher located 200 feet from the receiver.

7. The retail merchandise pusher system of embodiment 1, wherein the pusher controller calculates the number of retail items in the track based on a position of the pusher and on a size of the retail item.

8. The retail merchandise pusher system of embodiment 1, wherein the pusher controller is configured to repeat each wireless transmission of inventory data at least once.

9. The retail merchandise pusher system of embodiment 1, further comprising an upper-level system controller configured to receive the inventory data, and to transmit the inventory data to a networked computer server.

10. The retail merchandise pusher system of embodiment 9, wherein the upper-level system controller is configured to transmit, along with the inventory data, a unique identifier for the upper-level system controller.

11. The retail merchandise pusher system of embodiment 9, wherein the upper-level system controller is configured to receive data from the computer server.

12. The retail merchandise pusher system of embodiment 11, wherein the data received from the computer server includes a software update.

13. The retail merchandise pusher system of embodiment 9, wherein the upper-level system controller is configured to communicate directly with the pusher controller.

14. The retail merchandise pusher system of embodiment 9, wherein the upper-level system controller includes one or more visual indicators configured to indicate whether the upper-level system controller is receiving power, or transmitting data, or receiving data.

15. The retail merchandise pusher system of embodiment 1, wherein the pusher assembly includes an RFID reader to automatically scan an RFID device on each retail item.

16. The retail merchandise pusher system of embodiment 1, further comprising a networked computer server configured to receive and aggregate the inventory data transmitted by the pusher controller.

17. The retail merchandise pusher system of embodiment 16, wherein the inventory data is transmitted from the pusher controller to an upper-level system controller which then transmits the inventory data to the computer server.

18. The retail merchandise pusher system of embodiment 16, wherein the pusher controller is configured to transmit the inventory data to an upper-level controller, which is configured to transmit the inventory data via a network link to the computer server.

19. The retail merchandise pusher system of embodiment 18, wherein communication via the network link comprises communication via the internet, or via an intranet, or via an extranet.

20. A retail inventory management system comprising: the retail merchandise pusher system of embodiment 1; a computer server configured to receive and aggregate the inventory data transmitted by the pusher controller, the computer server being linked to a network and further configured to send the inventory data to a display of a client device, and wherein the computer server is configured to transmit inventory data to the display, in real-time, such that the display shows the inventory data from a plurality of pusher assemblies.

21. The retail inventory management system of embodiment 20, wherein the computer server causes the display to show the inventory data both graphically and textually.

22. The retail inventory management system of em-

bodiment 20, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in each pusher assembly on one or more shelves in a particular store.

23. The retail inventory management system of embodiment 20, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in one or more pusher assemblies in a particular store.

24. The retail inventory management system of embodiment 23, wherein the computer server is further configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for a particular SKU, disposed in the one or more pusher assemblies in each store of a plurality of stores.

25. The retail inventory management system of embodiment 20, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in one or more pusher assemblies in a particular store.

26. The retail inventory management system of embodiment 25, wherein the computer server is further configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in the one or more pusher assemblies in each store of a plurality of stores.

27. The retail inventory management system of embodiment 23, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of backstock items for the particular SKU in the particular store.

28. The retail inventory management system of embodiment 27, wherein the computer server is further configured to transmit inventory data to the display, in real-time, indicating the number of backstock items for every SKU in each store of a plurality of stores.

29. The retail inventory management system of embodiment 28, wherein the computer server is configured to automatically prompting a user to restock the one or more pusher assemblies using backstock items for one or more SKUs in one or more of the plurality of stores.

30. The retail inventory management system of embodiment 20, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of each retail item, for an entire department or category of retail items, disposed in one or more pusher assemblies in a particular store.

31. The retail inventory management system of embodiment 30, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating the number of each retail item, for the entire department or category of retail items, disposed in the one or more pusher assemblies in each store of a plurality of stores.

32. The retail inventory management system of embodiment 20, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of SKUs which are out-of-stock at a particular store.

33. The retail inventory management system of embodiment 32, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating each store of a plurality of stores where at least one SKU is out-of-stock.

34. The retail inventory management system of embodiment 33, wherein the computer server is configured to automatically generate a purchase order for an out-of-stock SKU, or to automatically generate an alert prompting a user to create the purchase order.

35. The retail inventory management system of embodiment 20, wherein the computer server is configured to transmit inventory data, simultaneously and in real-time, to a plurality of displays located locally or remotely from the computer server.

36. The retail inventory management system of embodiment 20, wherein the computer server is configured with multiple levels of access for users, wherein each access level has different privileges associated therewith.

37. The retail inventory management system of embodiment 20, wherein the client device is one of a desktop computer, a laptop computer, a notebook computer, a tablet computer, a smartphone, or a smartwatch.

38. The retail inventory management system of embodiment 20, wherein the computer server is configured to calculate and transmit inventory data to the display indicating a rate of inventory usage for one or more SKUs, or for one or more stores.

39. The retail inventory management system of embodiment 20, wherein the computer server is configured to calculate and transmit inventory data to the display indicating a rate of inventory usage by hour

of the day, day of the week, week of the month, or month of the year.

40. The retail inventory management system of embodiment 39, wherein the computer server is configured to analyze trends in the rate of inventory usage in order to determine when inventory at a particular store is to be replenished.

41. A retail merchandise display system comprising: a pusher assembly having a pusher configured to slide along a track of the pusher assembly, the pusher comprising:
a housing; a sensor arrangement carried with the housing, the sensor arrangement configured to detect a direction of movement of the pusher and a distance of travel of the pusher; and a controller configured to calculate, based on data from the sensor arrangement, a number of retail items in the track.

42. The retail merchandise display system of embodiment 41, wherein the sensor arrangement includes a direction sensor for detecting a direction of rotation of the spring drum indicative of a direction of movement of the housing and an incremental distance sensor for detecting incremental movement of the housing.

43. The retail merchandise display system of embodiment 41, wherein: the pusher includes: a spring drum rotatably mounted to the housing; and a coil spring mounted to the spring drum, the coil spring coilable and uncoilable upon rotation of the spring drum.

44. The retail merchandise display system of embodiment 41, further comprising a user interface configured to display an amount of inventory stored in the pusher assembly.

45. The retail merchandise display system of embodiment 41, wherein:
the sensor arrangement is configured to sense large-scale movement of the pusher and incremental movement of the pusher; the controller is configured to determine a change in inventory stored in the pusher assembly based on a total distance traveled by the pusher, the total distance being equal to a sum of the large-scale movement and the incremental movement, the change in inventory stored in the pusher being the total distance traveled by the pusher, divided by a product depth value of each retail item measured parallel to an axis of travel of the pusher along the track.

46. The retail merchandise display system of embodiment 41, further including a transmitter that wirelessly sends the distance of travel and direction of movement information.

47. The retail merchandise display system of embodiment 41, wherein
the controller is configured to determine a change in inventory stored in the pusher assembly by dividing a total distance traveled by the pusher by a product depth of each retail item measured parallel to an axis of travel of the pusher along the track.

48. The retail merchandise display system of embodiment 47, wherein the controller determines if the change is an increase in displayed inventory or a decrease in displayed inventory based on the direction of travel information sensed by the sensor arrangement.

49. The retail merchandise display system of embodiment 47, wherein the controller is configured to determine the product depth by receiving distance of travel information from a zero position from the sensor assembly sensed upon insertion of a predetermined number of retail items and then dividing the distance of travel information by the predetermined number of retail items.

50. The retail merchandise display system of embodiment 49, wherein the predetermined number of retail items is greater than or equal to one retail item.

51. The retail merchandise display system of embodiment 41, wherein the controller calculates the number of retail items in the track based on a position of the pusher and on a size of the retail item.

52. The retail merchandise display system of embodiment 51, wherein the position of the pusher is determined based on a distance traveled information and the direction of travel information after the system has been zeroed.

53. The retail merchandise display system of embodiment 51, wherein the controller calculates the number of retail items in the track based on an initial number of items manually input into the system and changes in the number of items based on the distance traveled information and the direction of travel information sensed after the initial number of retail items is input into the system.

54. The retail merchandise display system of embodiment 53, wherein the initial number of items is manually input into the system using a user interface remote from the pusher.

[0045] Other aspects, objectives and advantages of the invention will become more apparent from the following detailed description when taken in conjunction with

the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] The accompanying drawings incorporated in and forming a part of the specification illustrate several aspects of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:

FIG. 1 is a perspective view on exemplary embodiment of a retail merchandise display system that incorporates a pusher assembly constructed in accordance with an embodiment of the invention;

FIG. 2 is a side view of the retail merchandise display system of FIG. 1;

FIG. 3 is a schematic illustration of the operational topology of the retail merchandise display system, according to an embodiment of the invention;

FIG. 4 is a perspective exploded view of a pusher of the pusher assembly, according to an embodiment of the invention;

FIG. 5 is a side view of the pusher, with a portion of its outer housing removed, according to an embodiment of the invention;

FIG. 6 is a perspective view of the pusher, with a portion of its outer housing removed, according to an embodiment of the invention;

FIG. 7 is another perspective view of the pusher, with a portion of its outer housing removed, according to an embodiment of the invention;

FIG. 8 is a partial front view of an incremental distance sensor of the pusher, according to an embodiment of the invention;

FIG. 9 is a flowchart of the motion detection and alarm functionality of the pusher, according to an embodiment of the invention;

FIG. 10 is a schematic diagram for a retail merchandise pusher system, constructed in accordance with an embodiment of the invention;

FIG. 11 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing the amount of inventory by row or shelf in a store, in accordance with an embodiment of the invention;

FIG. 12 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing the amount of inventory for all stores served by the retail inventory management system, in accordance with an embodiment of the invention;

FIG. 13 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing the amount of inventory for specific stores served by the retail inventory management system, in accordance with an embodiment of the invention;

FIG. 14 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing the rate of inventory usage by day and by hour, in accordance with an embodiment of the invention;

FIG. 15 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing an inventory count by store and department, the display using a database table-based display primarily in text, according to an embodiment of the invention;

FIG. 16 is an exemplary screen shot of a graphic display provided by the computer server to a client device, the display showing an inventory count by brand and product description, the display using a database table-based display primarily in text, according to an embodiment of the invention;

FIG. 17 is an exemplary screen shot of a display provided by the computer server to a client device, the display showing the identity, contact information, and authorization level for individual users, in accordance with an embodiment of the invention;

[0047] While the invention will be described in connection with certain preferred embodiments, there is no intent to limit it to those embodiments. On the contrary, the intent is to cover all alternatives, modifications and equivalents as included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

[0048] Turning now to the drawings, the same illustrate an exemplary embodiment of a retail merchandise display system that incorporates a pusher assembly. The pusher assembly includes a pusher which includes a new and inventive sensor arrangement for detecting and calculating relatively small movements of the pusher. Such a configuration is highly advantageous for loss prevention and inventory management purposes, particularly loss prevention and inventory management of relatively small products.

[0049] Indeed, the high resolution of the distance de-

tection of the pusher enables an accurate calculation of a number of products removed from the retail merchandise display in a single movement cycle or in a given period of time. For example, a movement cycle (i.e., a continuous movement of the pusher) reflecting a relatively long distance traveled by the pusher is indicative of a number of products removed in a single movement of the pusher. As another example, a large number of separate movement cycles during a relatively short period of time is also indicative of a number of products removed from the display. In either case, each is indicative of a potential theft event. The system described herein is operable to generate one or both of a local and a remote alarm when such potential theft conditions are met. Further, the system described herein also communicates the information it collects regarding pusher movement for purposes of managing the inventory of that particular pusher assembly.

[0050] With particular reference to FIG. 1, the same illustrates an exemplary embodiment of a retail merchandise display system 20 (also referred to herein as display 20). Display 20 included one or more pusher assemblies 22 mounted to a shelf 24. Each pusher assembly 22 includes a pusher 26 that is slidable along a track 28. Each pusher 26 houses a coil spring described below which attaches to shelf 24 directly, or as shown in the illustrated embodiment, to an external structure that in turn is mounted to shelf 24 such as a mounting rail 30. The pusher 26 is biased by this coil spring 80 toward one end of the track 28. In the embodiment shown, the pusher 26 is biased by this coil spring 80 toward the mounting rail 30, i.e., from the back of shelf 24 toward the front of shelf 24.

[0051] As described in greater detail below, pusher 26 houses a sensor arrangement which is operable to calculate the distance traveled by pusher 26 along track 28, and to determine the direction of such travel, e.g., from the back to the front of shelf 24, or from the front to the back of shelf 24. In event that such movement is indicative of a potential theft event, pusher 26 is also operable to generate a local alarm at pusher 26, and/or a remote alarm at a receiver 40 of display 20 located remotely from the remainder of display 20. The term "alarm" as used herein should be taken to mean any audible or visual cue designed to draw attention to display 20, such as beeps, tones, prerecorded messages, flashing or continuous lights, etc., but is also intended to include any electronic signal which could be used to serve as a warning. Such remote alarm functionality is particularly advantageous as receiver 40 may be located with security or other personnel that can readily respond to a potential theft event. The remote alarm generated by receiver 40 may be simultaneous and in concert with the local alarm generated by the pusher 26.

[0052] Still referring to FIG. 1, two pusher assemblies 22 are illustrated. However, display 20 may utilize fewer or greater pusher assemblies. Indeed, in the case of smaller products, a relatively large number of pusher assemblies 22 may be situated on shelf 24. Further, display 20 may optionally also include a plurality of dividers 32 as shown, for keeping adjacent rows of product confined from one another. Each divider 32 may also include its own integrated front stop 34 as shown, for stopping the forward motion of products as they are biased by pusher 26. Alternatively, a front stop may be mounted directly to shelf 24 (or be formed by the shelf itself) or alternatively to mounting rail 30. With the foregoing description in hand, it will be readily recognized that mounting rail 30, dividers 32, and front stops 34 are optional components that may take on different forms or may be omitted entirely within the scope of the invention described herein.

[0053] Turning now to FIG. 2, pusher assembly 22, and particularly pusher 26, is operable to bias products 42 forward, i.e., in direction 50 shown in FIG. 2. The leading product 42 is removable from display 20 as shown. In a potential theft event, multiple or even all of products 42 may be removed in a single action, or in multiple quick successive actions. In either case, pusher 26 will move a relatively large distance forward in direction 50. As introduced above and described below, pusher 26 is operable to determine the distance it has traveled, and generate an appropriate alarm when the distance is beyond a predetermine threshold. As discussed herein, the alarm may be a visual alarm, audible alarm, or electronic signal such as a wireless or RF signal which could serve as a warning to the system user. Further, the alarm may be any combination or all of the aforementioned types.

[0054] With reference to FIG. 3, pusher 26 incorporates a new and inventive sensor arrangement for achieving the foregoing functionality. The topology shown in FIG. 3 depicts this sensor arrangement and additional componentry necessary to achieve the functionality herein. In particular, the sensor arrangement includes a spring drum sensor 62, a direction sensor 64, and an incremental distance sensor 66 which in combination determine the distance and direction traveled by pusher 26. Each of the foregoing components of the sensor arrangement is in operable communication with a controller 60. Controller 60 may for example be a microprocessor, or any other firmware, hardware, or software necessary to achieve the functionality herein.

[0055] Controller 60 is coupled to a local power supply 68 and an output device 70. Local power supply 68 provides electrical power to the controller and/or sensor arrangement to achieve the operation described herein. Output device 70 produces the above-introduced local alarm, and as such, may be embodied as any device capable of producing such an alarm. As will be explained in more detail below, the controller 60 is configured to calculate, based on data from the sensor arrangement, a total distance and direction of travel by the pusher 26, and to generate an alarm when the pusher 26 travels more than a threshold distance within a predetermined period of time. As will be explained below, the pusher 26 may include controls to allow the user to adjust the threshold distance and the predetermined period of time.

[0056] Controller 60 is also in communication with a

transmitter 72 which wirelessly sends the distance and direction of travel information, alarm status, and any other information collected by controller 60 to receiver 40, shown schematically in FIG. 3. As used in this application, the term "alarm status" refers to whether or not an alarm is being triggered or has been triggered by the controller 60. This wireless communication may use any known radio frequency (RF) communication protocol. The data transmitted from the controller 60 to the receiver 40 may include at least one or all of an inventory status, alarm status, and total distance and direction of travel by the pusher 26. In at least one embodiment of the invention, there are a plurality of pusher assemblies 22, wherein each one of the plurality of pusher assemblies 22 wirelessly communicates with the receiver 40. In certain embodiments, the receiver 40 includes at least one of an RF receiver, an audio speaker, and a Wi-Fi module which is configured to wirelessly transmit data (e.g., as an RF signal) received from the pusher 26.

[0057] Turning to FIG. 4, the same illustrates pusher 26 in a partially exploded view. Pusher 26 includes an outer housing 76 that has been partially removed to reveal the interior componentry of pusher 26. Pusher 26 carries a coil spring 80. Coil spring 80 is mounted on a spring drum 82. Spring drum 82 is rotatable about a shaft 84 to allow, in specific embodiments, an uncoiled portion of coil spring 80 to be paid out or retracted through an opening 86 formed in housing 76.

[0058] As can be seen in FIG. 4, spring drum 82 includes gear teeth 90a, 90b formed at opposed peripheral side edges of spring drum 82. Gear teeth 90a are used to repeatedly actuate a portion of direction sensor 64 as described below. Gear teeth 90b mesh with a sensing gear 92 of incremental distance sensor 66 as shown. As described in greater detail below, sensing gear 92 includes a slotted disc 94 mounted to or formed integrally with sensing gear 92.

[0059] Slotted disc 94 includes a plurality of slots 96 formed in a peripheral region thereof as shown. These slots successively block a beam of light of incremental distance sensor 66 as sensing gear 92 rotates. This action creates successive light pulses which are detected by incremental distance sensor 66 and used to measure the distance traveled by pusher 26 with a high resolution.

[0060] Each of the spring drum sensor 62, direction sensor 64, and incremental distance sensor 66 are coupled to a printed circuit board (PCB) 98 as shown to achieve the topology illustrated in FIG. 3. Additionally, a reset control 102 which may be a button, switch, or dial, and threshold distance control 104 are also coupled to PCB 98 to achieve the functionality described herein. Thus, embodiments of the pusher 26 include the reset control 102 to set a zero position for the controller 60, the zero position indicating that no merchandise is contained in the pusher assembly 22 such that the pusher 26 is at the front end of the track 28.

[0061] With reference to FIG. 5, when a portion of coil spring 80 is uncoiled and then is recoiled onto spring drum 82 by moving in direction 120, spring drum 82 rotates in direction 110 as shown. Movement of coil spring 80 in direction 120 is indicative of pusher 26 moving toward the front of shelf 24 (see FIGS. 1, 2), i.e., is indicative to a product or products 42 being removed from display 20.

[0062] Due to the contact between spring drum 82 and sensing gear 92, this causes sensing gear 92 and its associated slotted disc 94 to rotate in direction 116 as shown. Conversely, movement of spring 80 in direction 122 causes spring drum 82 to rotate in direction 112 as shown. Movement of coil spring 80 in direction 122 is indicative to pusher 26 moving toward the back of shelf 24 (see FIGS. 1, 2), i.e., is indicative of product or products 42 being restocked into display 20. This in turn causes sensing gear 92 and slotted disc 94 to rotate in direction 114.

[0063] Turning now to FIG. 6, the operation of spring drum sensor 62 and direction sensor 64 will be described in greater detail. Turning first to spring drum sensor 62, the same includes a pair of opposed electrical contacts 134, 136 as shown. Contact 134 is coupled to PCB 98 by way of a housing 130. Similarly, contact 136 is coupled via a housing 132 to PCB 98. Each electrical contact 134, 136 is generally flexible so that it may readily move into and out of contact with the other contact.

[0064] As spring drum 82 rotates, a radially protruding tab 140 mounted to a hub 142 of spring drum 82 rotates as well. Upon each full revolution of spring drum 82, tab 140 will bias contacts 134, 136 together. In the illustration of FIG. 6, spring drum 82 is rotating in direction 110, and thus tab 140 has biased contact 134 into contact with 136.

[0065] Controller 60 is operable to detect when electrical contacts 134, 136 are in contact with one another, and records this information. Two successive contacts between electrical contacts 134, 136 signifies one full revolution of spring drum 82, which corresponds to a linear movement of spring 80 and hence a linear movement of pusher 26.

[0066] Direction sensor 64 is used to detect the rotational direction of spring drum 82 as movement is detected. Indeed, while two successive contacts of electrical contacts 134, 136 provides an indication of a linear distance moved by pusher 26, these contacts do not provide an indication of which direction pusher 26 was moving during that time. The operation of direction sensor 64 is thus used to correlate a direction with the movement detected.

[0067] Direction sensor 64 includes a first electrical contact 150, a second electrical contact 152, and a common electrical contact 154 interposed between first and second electrical contacts. Common electrical contact 154 is resiliently movable into contact with either one of first or second electrical contacts 150, 152. Each of these contacts, 150, 152, and 154 are insulated from one another via a housing 156, and coupled to PCB 98.

[0068] For example, as spring drum 82 rotates in direction 110 as shown, a distal end of common electrical

contact 154 is intermittently but repeatedly contacted by the teeth of gear teeth 90a, and repeatedly brought into contact with first electrical contact 150. Conversely, when spring drum 82 rotates in direction 112 (see FIG. 5), common electrical contact 154 is repeatedly brought into contact with second electrical contact 152. Controller 60 is operable to recognize that successive contact between common electrical contact 154 and first electrical contact 150 is indicative of pusher 26 moving toward the front of shelf 24 (see e.g., FIGS. 1, 2). Conversely, controller 60 is also operable to recognize that successive contact between common electrical contact 154 and second electrical contact 152 is indicative of pusher 26 moving toward the rear of shelf 24 (see e.g., FIGS. 1, 2).

[0069] It will be recognized, however, that spring drum sensor 62 can detect only large-scale movement of pusher. As used herein, "large-scale movement" means movement of pusher 26 which corresponds to one full revolution of spring drum 82. In order to determine incremental movement of pusher 26, incremental distance sensor 66 is employed. As used herein, "incremental movement" of pusher 26 means movement that is less than a large-scale movement. Indeed, in a single movement cycle, i.e., an uninterrupted movement of pusher 26, the same may move some distance prior to and/or after the two successive contacts of contacts 134, 136 that signifies one large-scale movement. Incremental distance sensor 66 is thus used to determine this additional distance. In some embodiments, only a single distance sensor, such as incremental distance sensor 66, may be employed.

[0070] With reference to FIGS. 7 and 8, incremental distance sensor 66 includes the aforementioned sensing gear 92 and slotted disc 94, which are rotatable about an axis defined by shaft 144 upon a corresponding rotation in spring drum 82. Incremental distance sensor 66 also includes a light sensor arrangement comprising a light emitter 160 aimed at a light receiver 162 for detecting the presence or absence of a beam of light emitted from emitter 160. Emitter 160 and receiver 162 are mounted to a housing 164 as shown. Housing 164 includes a slot 164 which defines a sensing region. The peripheral region of slotted disc 94 rotates through this sensing region. The slots 96 thereby successively interrupt the beam of light from emitter 160.

[0071] As a result, receiver 162 detects pulses of light. Due to the equally spaced and regular arrangement of slots 96, these pulses thus each correspond to a small linear movement of pusher 26. Put differently, the pulses can be summed at controller 60 so as to determine a total distance moved by pusher 26 in any given movement cycle. Due to this very fine measurement, the resolution of distance measurement of pusher 26 is relatively high. As such, even very minor movements of pusher 26 corresponding for example very thin products 42 being removed can be detected. It will be recognized that incremental distance sensor 66 thus functions as a rotary encoder used for linear distance measurement.

[0072] The following provides an example of the distance measurement functionality of pusher 26. In this particular example, the gear ratio between spring drum 82 and sensing gear 92 is 1:4. Spring drum 82 has an outer diameter of 13.5 mm. As a result, one full revolution of spring drum 82 as detected by spring drum sensor 62 corresponds to 84.8 mm (i.e., 2*pi*13.5). Also in this example, there are 40 slots 96 formed on slotted disc 94. As such, one full revolution of slotted disc 94 generates 40 light pulses. Due to the aforementioned 1:4 gear ratio, one full revolution of spring drum 82 will cause four full revolutions of slotted disc 94, and hence 160 light pulses for every one full revolution of spring drum 82. Dividing the circumference of spring drum 82 by this total number of pulses, (i.e., 84.8 mm/160 pulses) each pulse therefor corresponds to 0.53 mm of linear movement.

[0073] For the purposes of this example, it will be assumed that pusher 26 has moved 200 mm in a movement cycle. From start to finish in this movement cycle, pusher 26 will first move some distance prior to contacts 134, 136 making their first contact. These contacts 134, 136 will then make a second contact after spring drum 82 completes a full revolution (i.e., a revolution as measured by a first and a second contact of contacts 134, 136). Contacts 134, 136 will then make a third contact after another full revolution of spring drum 82 (i.e., as measured by the third contact of contacts 134, 136 occurring after the aforementioned second contact). Pusher will then move some distance after this third contact.

[0074] During the aforementioned movement, incremental distance sensor 66 sensed pulses of light. Assume for this example 15 pulses were detected prior to the first contact of contacts 134, 136, this distance portion correlates to a distance of 15*0.53 mm or 7.95 mm. Also assume for this example that 42 pulses were detected after the third contact of contacts 134, 136, this distance portion correlates to a distance of 42*0.53 mm or 22.26 mm. Also, as already mentioned, three total contact events between contacts 134, 136 were detected, which amounts to two full revolutions of spring drum 82, correlating to a distance portion of 169.6 mm. Summing the aforementioned distance portions, a total travel distance of approximately 200 mm has been detected.

[0075] In terms of loss prevention, the user can set an alarm threshold distance using threshold distance control 104 which may be a button, switch, dial, or any similarly suitable means for setting the alarm threshold distance. This threshold distance is the distance in a movement cycle observed by pusher 26 in which an alarm will be generated. The pusher 26 may include a control, similar to the threshold distance control 104, which allows the user to adjust a time period during which the alarm threshold distance must be exceeded in order to generate the alarm. All distance measurements and alarm conditions can be transmitted to receiver 40. Further, receiver 40 may be in communication with or embody inventory management software such that in addition to loss prevention, each pusher assembly 22 can also communicate infor-

mation regarding its stock status, etc. As such, receiver 40 may incorporate or be in communication with a user interface for inputting an alarm threshold and/or a product depth as discussed below. In general, the capability of high-resolution distance measurement can be used for anti-theft and inventory management functions.

[0076] Referring back momentarily to FIG. 1, in terms of inventory management, the data communicated by each pusher 26 is also associated with a unique location identifier for each pusher. This enables the inventory management software to differentiate between the various pushers 26 in the system, and monitor the inventory of each. As such, a user can also define a product size for, i.e., depth, for one item of product in the pusher assembly 22. The pusher 26 may then correlate the locally at controller 60, or remotely at receiver 40 or any inventory management software integrated with or in communication with receiver 40, the distance it has traveled to a number of products removed from pusher assembly 22. As an example, a user may indicate that a single item has a one-inch depth. A movement of ten inches, therefore, amounts to ten products being removed. A user may set this minimum product depth using threshold distance control 104, or they may set it at receiver 40 or the inventory management software embedded in or associated therewith. The threshold distance control 104 may be a dial, button, switch, or any suitable means for setting the minimum product depth. Alternatively, product depth may be learned by the system by zeroing the system and then inserting a predetermine number of products. The system can use the distance traveled when the predetermined number of products is inserted divided by the number of products to determine the minimum product depth. For small product depths, it may be desirable to insert numerous products at this learning process to have more accurate readings to determine he minimum product depth.

[0077] Turning now to FIG. 9, the same illustrates the basic control logic of each pusher assembly 22. Starting at step 200, each pusher 26 must be "zeroed" by activating its reset control, such as a switch, dial, or button, when no product 42 is loaded therein, i.e., when coil spring 80 has drawn pusher 26 as close as is possible to the front of shelf 24. This is recorded at step 202 as the zero position. Thereafter, pusher 26 remains in sleep mode at step 204 until motion is detected at 206. Upon this detection, pusher 26 exits sleeps mode and monitors and calculates the distance it has moved at step 210 using the sensor arrangement described above.

[0078] At step 212 a determination is also made as to whether pusher 26 is moving up (i.e., toward the front of shelf 24) or down (i.e., toward the rear of shelf 24). If moving down, the process loops back to step 204. If moving up, the process continues to step 214 where a determination of whether the first rotation marker (i.e., a contact of contacts 134, 136) has been detected. If yes, this information is updated at step 216. After step 216, or if no contact of contacts 134, 136 is detected, the process moves on to step 218 and records the distance moved forward. This distance is then analyzed at step 220 to see if it is greater than a first threshold, i.e., a "beep" threshold where only a temporary alarm is generated. If it is not greater than this threshold, at step 260 transmitter 72 then sends RF data corresponding to the original position of pusher 26, the distance pusher 26 moved, the direction pusher 26 moved, and an alarm status.

[0079] If, however, at step 220 the distance moved is such that the temporary alarm should be generated, at check is performed at step 222 to confirm whether or not the distance moved is great enough to warrant a full alarm. If yes, at step 226 the alarm status is saved and an alarm of five seconds in duration is generated at step 228. If, at step 222 it is determined that the alarm threshold has not been met, then an additional check at step 224 is performed to determine whether the threshold at step 220 has been exceeded within a time period of ten seconds. If no, the temporary alarm status is saved at step 230 and only the temporary alarm is generated at step 232. At the end of either of steps 228 or 232, RF information is sent at step 260.

[0080] If the check at step 220 is no, or if either of steps 228 or 232 are completed, the process then proceeds to step 240, to determine whether the pusher is at its previously-set zero position. If yes, then the foregoing steps are repeated as necessary upon movement of pusher 26. If not, the process moves onto step 242 where pusher 26 returns to sleep mode. Pusher 26 exits sleep mode at step 246 and monitors and calculates the distance it has moved at step 248. A determination at step 250 is conducted to determine whether the pusher 26 has moved up or down in the same manner as described above relative to step 212. If moving up, the process proceeds to step 218 and continues as described above. If moving down, this distance is recorded at step 252. A determination is then made at step 254 as to whether pusher 26 has returned to its zero position. If so, it is recorded at step 256 that the pusher is at its zero position, and the process continues to step 220. If not, nothing is recorded, and the process continues to step 220.

[0081] In certain embodiments of the invention, a retail merchandise pusher system 300 includes the pusher 26 and pusher assembly 22 described above to produce an inventory management system in which the pusher controller 60 is configured to calculate, based on data from the sensor arrangement, a number of retail items in the track 28, and to wirelessly transmit inventory data indicative of the number of retail items in the track 28. FIG. 10 is a schematic diagram for a retail merchandise pusher system, constructed in accordance with an embodiment of the invention. The sensor arrangement is configured to accurately determine the location of the pusher 26 along the track 28. Based on this determined pusher position, and based on the physical dimensions of the retail items (e.g., product depth described above) in the pusher assembly 22, it is possible to determine how many retail items are in the pusher assembly 22.

[0082] In particular embodiments, the pusher controller 60 is further configured to transmit a unique identifier for the pusher assembly 22. Additionally, the pusher assembly 22 may include a UPC reader or QR code scanner to automatically scan a UPC or QR code on each retail item. In some embodiments, the retail merchandise pusher system 300 includes the receiver 40, located remotely from the pusher assembly 22, where the receiver 40 is configured to receive the inventory data and to transmit the inventory data to an upper-level system controller 276.

[0083] In a further embodiment, the receiver 40 is configured to transmit, along with the inventory data, a unique identifier for the receiver 40. In the embodiment shown in FIG. 10, the receiver 40 includes an external antenna 41, which enables the receiver 40 to receive data from one or more pushers 26 located up to 200 feet from the receiver 40. Without the external antenna 41, the receiver 40 would still be able to receive data from the one or more pushers 26, but only from pushers 26 located about 20 to 30 feet from the receiver 40. As indicated above, in certain embodiments, the pusher controller 60 calculates the number of retail items in the track 28 based on a position of the pusher 26 and on a size of the retail item. Furthermore, the pusher controller 60 may be configured to repeat each wireless transmission of inventory data at least once. Repeating the wireless transmission ensures that the receiver 40 or the upper-level system controller 276 receives the wireless signal. If the first transmission is not recognized, a second or third transmission makes it likely that one of the transmissions will be received.

[0084] In particular embodiments, an upper-level system controller 276 is configured to receive the inventory data, and to transmit the inventory data to a networked computer server 270. The upper-level system controller 276 may be configured to transmit, along with the inventory data, a unique identifier for the upper-level system controller 276. Furthermore, the upper-level system controller 276 may be configured to receive data from the computer server 270. In a particular embodiment, the data received from the computer server 270 includes a software update. The retail merchandise pusher system 300 includes an embodiment where the upper-level system controller 276 is configured to communicate directly with the pusher controller 60. Additionally, the upper-level system controller 276 may include one or more visual indicators configured to indicate whether the upper-level system controller 276 is receiving power, or transmitting data, or receiving data.

[0085] In a further embodiment, the pusher assembly 22 includes an RFID reader to automatically scan an RFID device on each retail item. Embodiments of the retail merchandise pusher system 300 also include a networked computer server 270 configured to receive and aggregate the inventory data transmitted by the pusher controller 60. In some embodiments, the inventory data is transmitted from the pusher controller 60 to an upper-level system controller 276 which then transmits the inventory data to the computer server 270. In particular embodiments such as that of FIG. 10, the pusher controller 60 is configured to transmit the inventory data to an upper-level controller 276, which is configured to transmit the inventory data via a network link 280 to the computer server 270. Communication via the network link 280 includes communication via the internet, or via an intranet, or via an extranet.

[0086] In yet another aspect, embodiments of the invention provide a retail inventory management system 400 that includes the retail merchandise pusher system 300 described above. Further, a computer server 270 is configured to receive and aggregate the inventory data transmitted by the pusher controller 60. The computer server 270 is linked to a network 280 and further configured to send the inventory data to a display of a client device 272. The computer server 270 is configured to transmit inventory data to the display, in real-time, such that the display shows the inventory data from a plurality of pusher assemblies 22. In embodiments of the retail inventory management system 400, the computer server 270 causes the display to show the inventory data both graphically and textually. FIGS. 11-14 show example of these graphical and textual displays. More specifically, FIGS. 11-14 are exemplary screen shots that illustrating some of the displays provided by the computer server 270 to a client device 272 of a user.

[0087] In inventory management, a stock keeping unit (SKU) is the unit of measure in which the stocks of a material are managed. The SKU is usually represented by an alphanumeric string of characters, but may also be printed and attached to a retail item, or to the packaging for a retail item, as a scannable bar code. The alphanumeric characters of the SKU make up a code that allows the merchant to track the price, product detail, manufacturer, and point-of-sale for the retail item. Typically, each unique product has its own unique SKU number.

[0088] A UPC, or universal product code, is a numeric code (usually a 12-digit string) that is attached to products wherever they are sold, for external use. The UPC serves a purpose similar to that of the SKU but, generally, a product has the same UPC no matter where, or by whom, it is sold, whereas different merchants tend to assign their own unique SKU. In this way, SKUs are typically unique to a single retailer.

[0089] FIG. 11 is an exemplary screen shot of a display provided by the computer server 270 to a client device 272, the display showing the amount of inventory by row or shelf in a store 278, according to an embodiment of the invention. In particular embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in each pusher assembly 22 on one or more shelves in a particular store 278. In other embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU,

disposed in one or more pusher assemblies 22 in a particular store 278.

[0090] FIG. 12 is an exemplary screen shot of a graphic display provided by the computer server 270 to a client device 272, the display showing the amount of inventory for all stores 278 served by the retail inventory management system 400, in accordance with an embodiment of the invention, while FIG. 13 is an exemplary screen shot of a graphic display provided by the computer server 270 to a client device 272, the display showing the amount of inventory for specific stores 278 served by the retail inventory management system 400, in accordance with an embodiment of the invention. As can be seen from the exemplary displays of FIGS. 12 and 13, the computer server 270 may be configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for a particular SKU, disposed in the one or more pusher assemblies 22 in each store 278 of a plurality of stores 278. In some embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in one or more pusher assemblies 22 in a particular store 278. However, the computer server 270 may also be configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in the one or more pusher assemblies 22 in each store 278 of a plurality of stores 278.

[0091] The exemplary screen shot of FIG. 11 shows a display in which the inventory for a store is broken down by row and fixture-type. FIG. 11 indicates that Row 1 has five pusher assemblies 22, and two merchandise hooks. In the screen shot of FIG. 11, each row has one box 282 for each pusher assembly 22 or merchandise hook in that row of the store 278. At the top of each box 282, the SKU number and a user-specified descriptor identify the retail item on that particular pusher assembly 22 or merchandise hook. At the bottom of the box 282 is the number of retail items on the pusher assembly 22 or merchandise hook, and a total number that adds the number of retail items on the pusher assembly 22 or merchandise hook and the number of retail items in backstock.

[0092] In a column 284 to the left of the boxes 282, the display shows aggregated or total number for the items on that row. The column 284 includes icons, which may be color-coded to categorize the retail items in that row. The first icon 286 is next to the number of customer-facing (i.e., on pusher assemblies 22 or hooks) retail items for that row. The second icon 288 is next to the number of backstock items for the SKUs in that row. The third icon 290 indicates an error coding, and indicates the number of devices that are not calibrated, or has incorrect SKU information assigned to the device. The display page of FIG. 11 also includes dropdowns that allow the user to choose the store, section of the store, and department whose inventory is to be displayed.

[0093] Referring again to FIG. 11, In certain embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating a number of backstock items for the particular SKU in the particular store 278. However, the computer server 270 may also be configured to transmit inventory data to the display, in real-time, indicating the number of backstock items for every SKU in each store 278 of a plurality of stores 278. Further still, the computer server 270 may be configured to automatically prompting a user to restock the one or more pusher assemblies 22 using backstock items for one or more SKUs in one or more of the plurality of stores 278.

[0094] The computer server 270 is also configured to provide displays in more traditional formats. Some displays may not use the icons and other graphical tools shown in FIGS. 11-14. For example, FIG. 15 is an exemplary screen shot of a graphic display provided by the computer server 270 to a client device 272, the display showing an inventory count by store 278 and department, in which the display uses a database table-based format which mainly uses text with only a few graphic icons, according to an embodiment of the invention. Similarly, FIG. 16 is an exemplary screen shot of a graphic display provided by the computer server 270 to a client device 272, the display showing an inventory count by brand and product description, where the display provides a database table-based format primarily using text with minimal icon usage, in accordance with an embodiment of the invention.

[0095] In some embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating a number of each retail item, for an entire department or category of retail items, disposed in one or more pusher assemblies 22 in a particular store 278. In other embodiments, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating the number of each retail item, for the entire department or category of retail items, disposed in the one or more pusher assemblies 22 in each store 278 of a plurality of stores 278.

[0096] Additionally, the computer server 270 may be configured to transmit inventory data to the display, in real-time, indicating a number of SKUs which are out-of-stock at a particular store 278. In a further embodiment, the computer server 270 is configured to transmit inventory data to the display, in real-time, indicating each store 278 of a plurality of stores 278 where at least one SKU is out-of-stock. In more particular embodiments, the computer server 270 is configured to automatically generate a purchase order for an out-of-stock SKU, or to automatically generate an alert prompting a user to create the purchase order.

[0097] FIG. 14 is an exemplary screen shot of a display provided by the computer server 270 to a client device 272, the display showing the rate of inventory usage by day and by hour, in accordance with an embodiment of the invention. In a particular embodiment, the computer server 270 is configured to calculate and transmit inventory data to the display indicating a rate of inventory us-

age for one or more SKUs, or for one or more stores 278. Additionally, the computer server 270 may be configured to calculate and transmit inventory data to the display indicating a rate of inventory usage by hour of the day, day of the week, week of the month, or month of the year. As can be seen from FIG. 14, the user may access this rate of inventory usage for a particular store, department, category, brand, or client. Furthermore, the computer server 270 may be configured to analyze trends in the rate of inventory usage in order to determine when inventory at a particular store 278 is to be replenished.

[0098] FIG. 17 is an exemplary screen shot of a display provided by the computer server 270 to a client device 272, the display showing the identity, contact information, and authorization level for individual users, in accordance with an embodiment of the invention. The computer server 270 nay also be configured to transmit inventory data, simultaneously and in real-time, to a plurality of displays located locally or remotely from the computer server 270. In a further embodiment, the computer server 270 is configured with multiple levels of access for users, wherein each access level has different privileges associated therewith. As shown in FIG. 17, the computer server 270 is configured to maintain and display a list of users and the access level or authorization level granted to the users. In some embodiments of the retail inventory management system 400, the client device 272 is one of a desktop computer, a laptop computer, a notebook computer, a tablet computer, a smartphone, or a smartwatch.

[0099] All references, including publications, patent applications, and patents cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

[0100] The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) is to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

[0101] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

[0102] All references, including publications, patent applications, and patents cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

Claims

1. A retail merchandise pusher system comprising:
   a pusher assembly having a pusher configured to slide along a track of the pusher assembly, the pusher assembly being mountable to a retail merchandise shelf, the pusher comprising:
      a housing;
      a spring drum rotatably mounted within the housing;
      a coil spring mounted to the spring drum, the coil spring coilable and uncoilable upon rotation of the spring drum; and
      a pusher controller coupled to a sensor arrangement carried within the housing, the sensor arrangement comprising:
         a spring drum sensor for detecting rotation of the spring drum;
         a direction sensor for detecting a direction of rotation of the spring drum; and
         an incremental distance sensor for detecting an incremental movement of the pusher;
   wherein the pusher controller is configured to calculate, based on data from the sensor arrangement, a number of retail items in the track, and to wirelessly transmit inventory data indicative of the number of retail items in the track.

2. The retail merchandise pusher system of claim 1, wherein the pusher controller is further configured to transmit a unique identifier for the pusher assem-

bly.

3. The retail merchandise pusher system of claim 1, wherein the pusher assembly includes a UPC reader, RFID reader, or QR code scanner to automatically scan a UPC code, RFID tag, or QR code on each retail item.

4. The retail merchandise pusher system of any of claims 1 through 3, further comprising a receiver, located remotely from the pusher assembler, the receiver configured to receive the inventory data and to transmit the inventory data , wherein the receiver is further configured to transmit a unique identifier for the receiver to an upper-level system controller.

5. The retail merchandise pusher system of any of claims 1 through 4, wherein the pusher controller calculates the number of retail items in the track based on a position of the pusher and on a size of the retail item.

6. The retail merchandise pusher system of any of claims 1 through 5, wherein the pusher controller is configured to repeat each wireless transmission of inventory data at least once.

7. The retail merchandise pusher system of any of claims 1 through 6, further comprising an upper-level system controller configured to receive the inventory data, and further configured to transmit the inventory data to a networked computer server and receive data from the computer server, the upper-level system controller being configured to transmit, along with the inventory data, a unique identifier for the upper-level system controller.

8. The retail merchandise pusher system of any of claims 1 through 7, further comprising a networked computer server configured to receive and aggregate the inventory data transmitted by the pusher controller, wherein the inventory data is transmitted from the pusher controller to an upper-level system controller which then transmits the inventory data to the computer server, wherein the pusher controller is configured to transmit the inventory data to an upper-level controller, which is configured to transmit the inventory data via a network link to the computer server.

9. The retail merchandise pusher system of any of claims 1 through 8, further comprising a user interface configured to display an amount of inventory stored in the pusher assembly.

10. The retail merchandise display system of any of claims 1 through 9, wherein the pusher controller determines if the change is an increase in displayed inventory or a decrease in displayed inventory based on the direction of travel information sensed by the sensor arrangement, the pusher controller being further configured to determine the product depth by receiving distance of travel information from a zero position from the sensor assembly sensed upon insertion of a predetermined number of retail items and then dividing the distance of travel information by the predetermined number of retail items, wherein a position of the pusher is determined based on a distance traveled information and the direction of travel information after the system has been zeroed.

11. The retail merchandise display system of any of claims 1 through 9, wherein the pusher controller calculates the number of retail items in the track based on an initial number of items manually input into the system and changes in the number of items based on the distance traveled information and the direction of travel information sensed after the initial number of retail items is input into the system.

12. A retail inventory management system comprising:

the retail merchandise pusher system of claim 1; a computer server configured to receive and aggregate the inventory data transmitted by the pusher controller, the computer server being linked to a network and further configured to send the inventory data to a display of a client device, and wherein the computer server is configured to transmit inventory data to the display, in real-time, such that the display shows the inventory data from a plurality of pusher assemblies.

13. The retail inventory management system of claim 12, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of retail items, for a particular SKU, disposed in each pusher assembly on one or more shelves in a particular store, or disposed in one or more pusher assemblies in a particular store, or in each store of a plurality of stores.

14. The retail inventory management system of claim 12 or claim 13, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating the number of retail items, for every SKU, disposed in one or more pusher assemblies in a particular store, or in each store of a plurality of stores.

15. The retail inventory management system of any of claims 12 through 14, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of backstock items for a particular SKU in a particular store, or for every

SKU in each store of a plurality of stores.

16. The retail inventory management system of any of claims 12 through 15, wherein the computer server is configured to automatically prompting a user to restock the one or more pusher assemblies using backstock items for one or more SKUs in one or more of the plurality of stores.

17. The retail inventory management system of any of claims 12 through 16, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of each retail item, for an entire department or category of retail items, disposed in one or more pusher assemblies in a particular store, or in each store of a plurality of stores.

18. The retail inventory management system of any of claims 12 through 17, wherein the computer server is configured to transmit inventory data to the display, in real-time, indicating a number of SKUs which are out-of-stock at a particular store, or indicating each store of a plurality of stores where at least one SKU is out-of-stock, the computer server being further configured to automatically generate a purchase order for an out-of-stock SKU, or to automatically generate an alert prompting a user to create the purchase order.

19. The retail inventory management system of any of claims 12 through 18, wherein the computer server is configured to calculate and transmit inventory data to the display indicating a rate of inventory usage for one or more SKUs, or for one or more stores, or indicating the rate of inventory usage by hour of the day, by day of the week, by week of the month, or by month of the year.

20. The retail inventory management system of any of claims 12 through 19, wherein the computer server is configured to analyze trends in the rate of inventory usage in order to determine when inventory at a particular store is to be replenished.

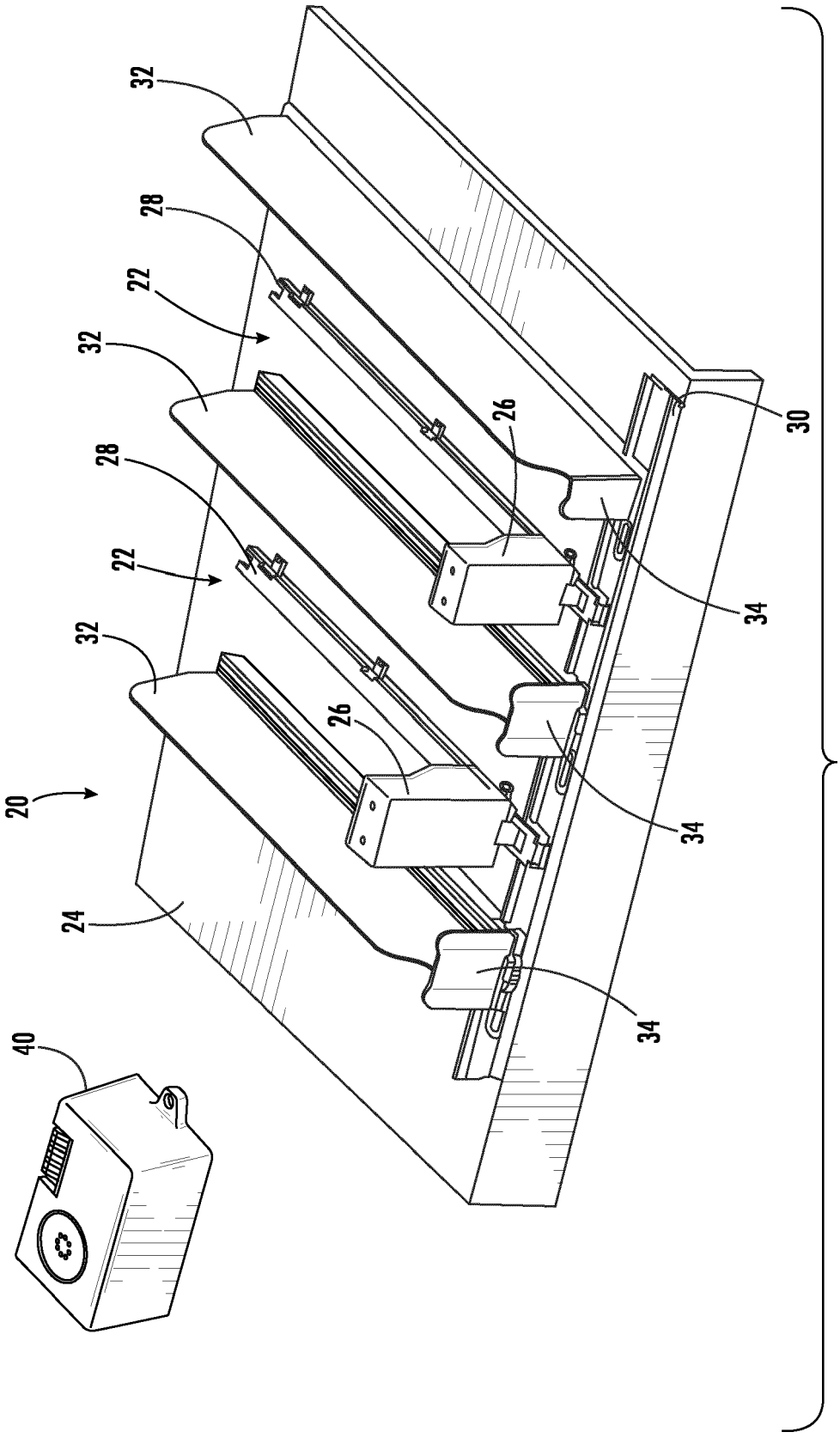

FIG. 1

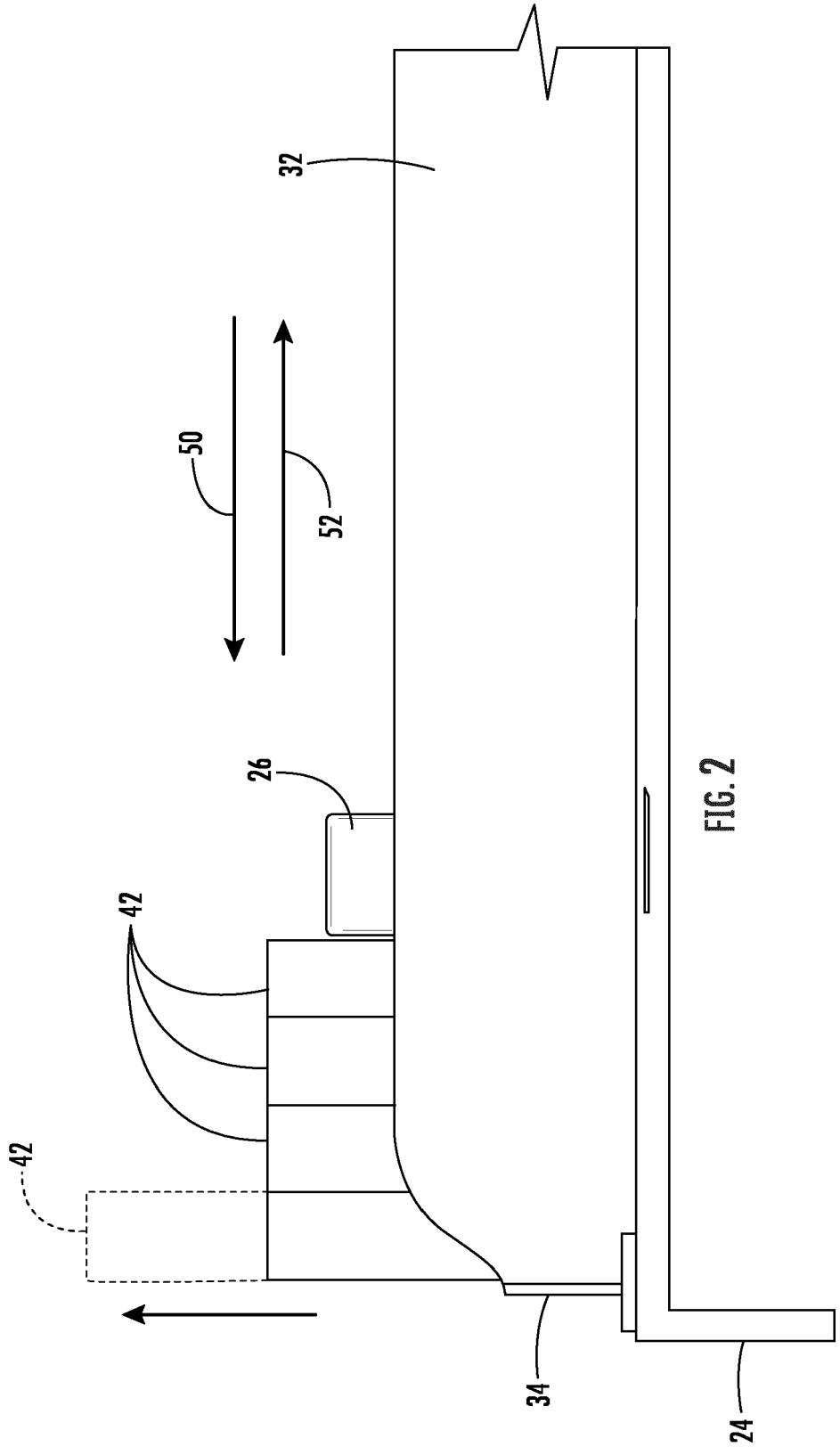

FIG. 2

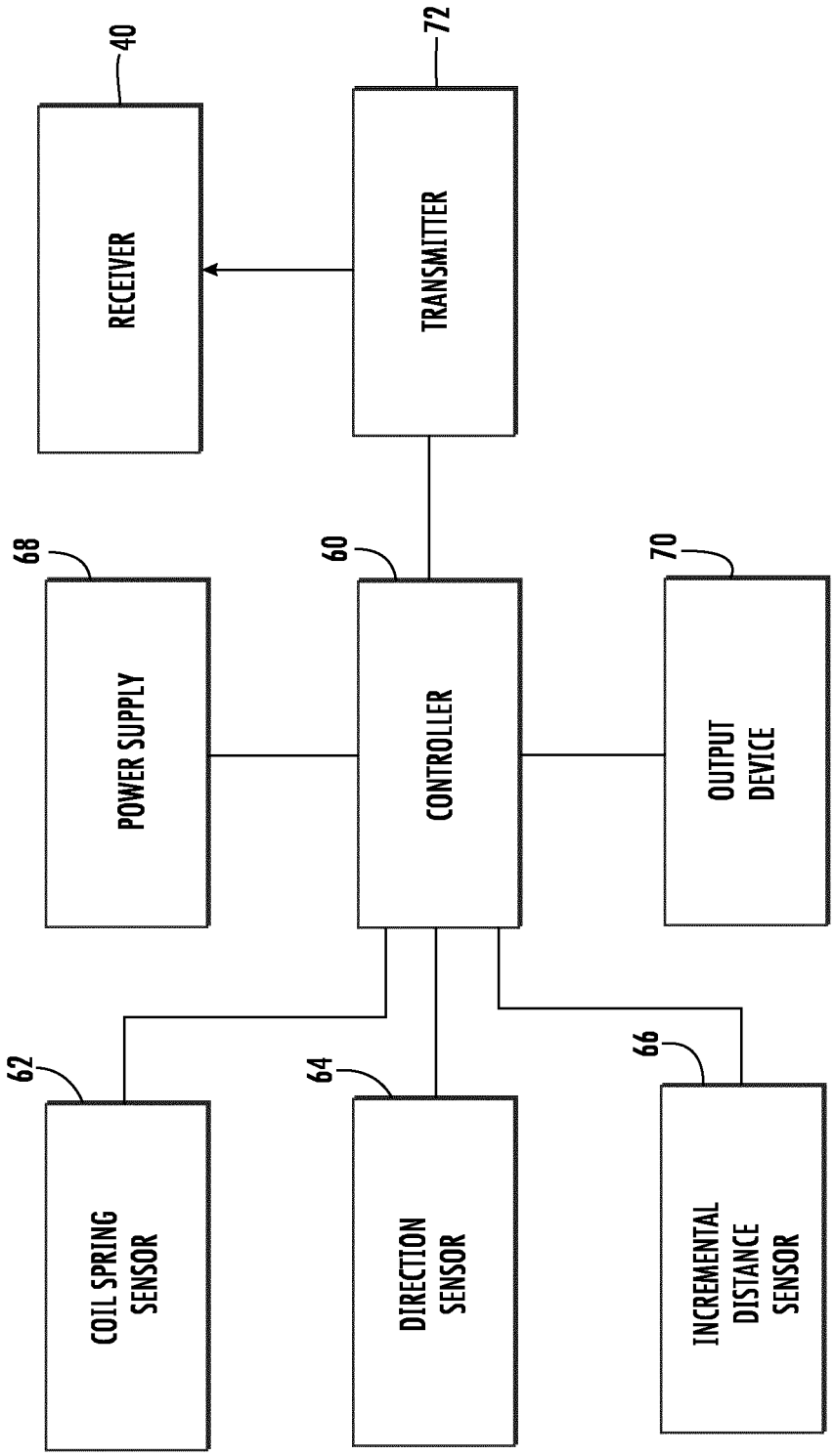
40
RECEIVER
72
TRANSMITTER
68
POWER SUPPLY
60
CONTROLLER
70
OUTPUT DEVICE
62
COIL SPRING SENSOR
64
DIRECTION SENSOR
66
INCREMENTAL DISTANCE SENSOR

FIG. 3

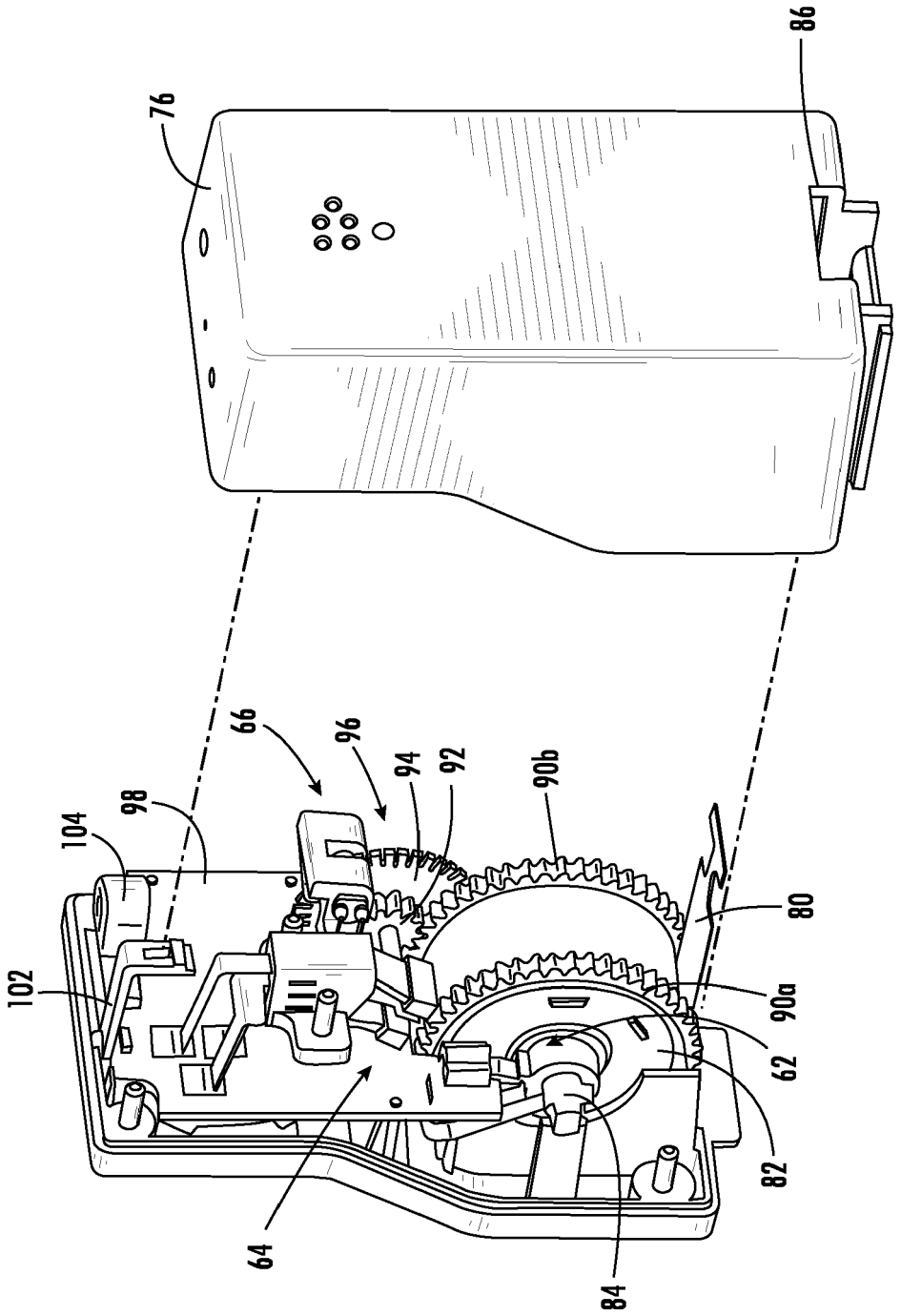

FIG. 4

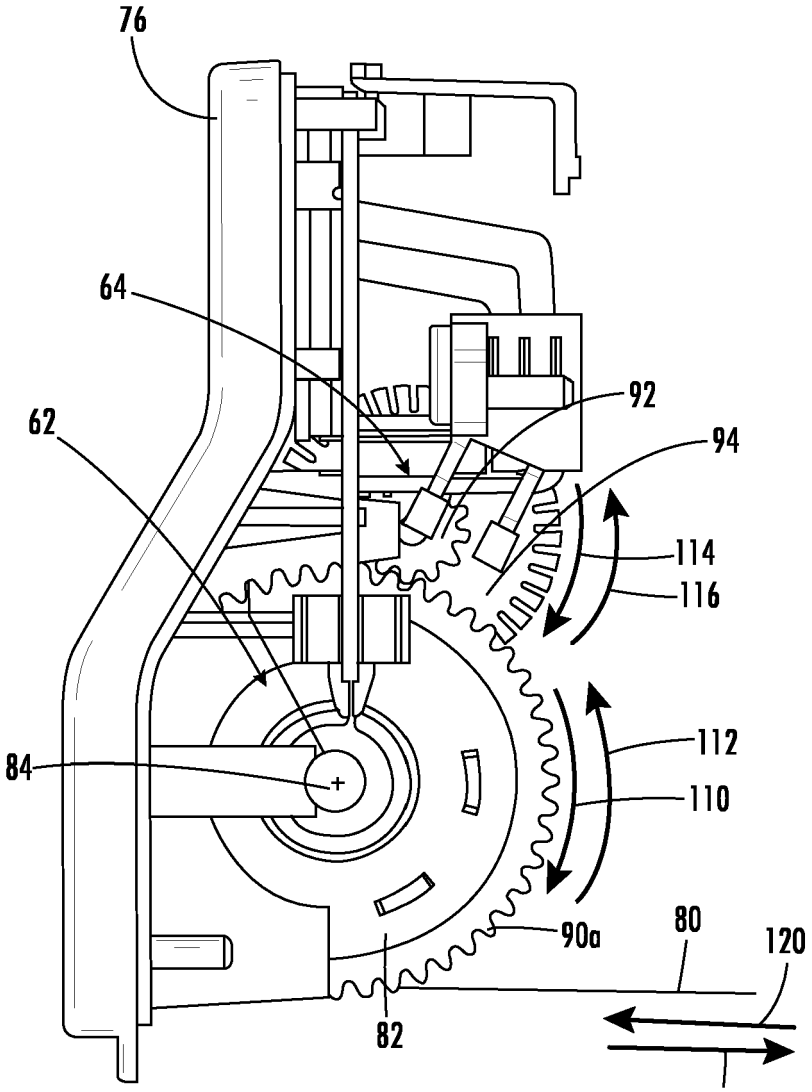

FIG. 5

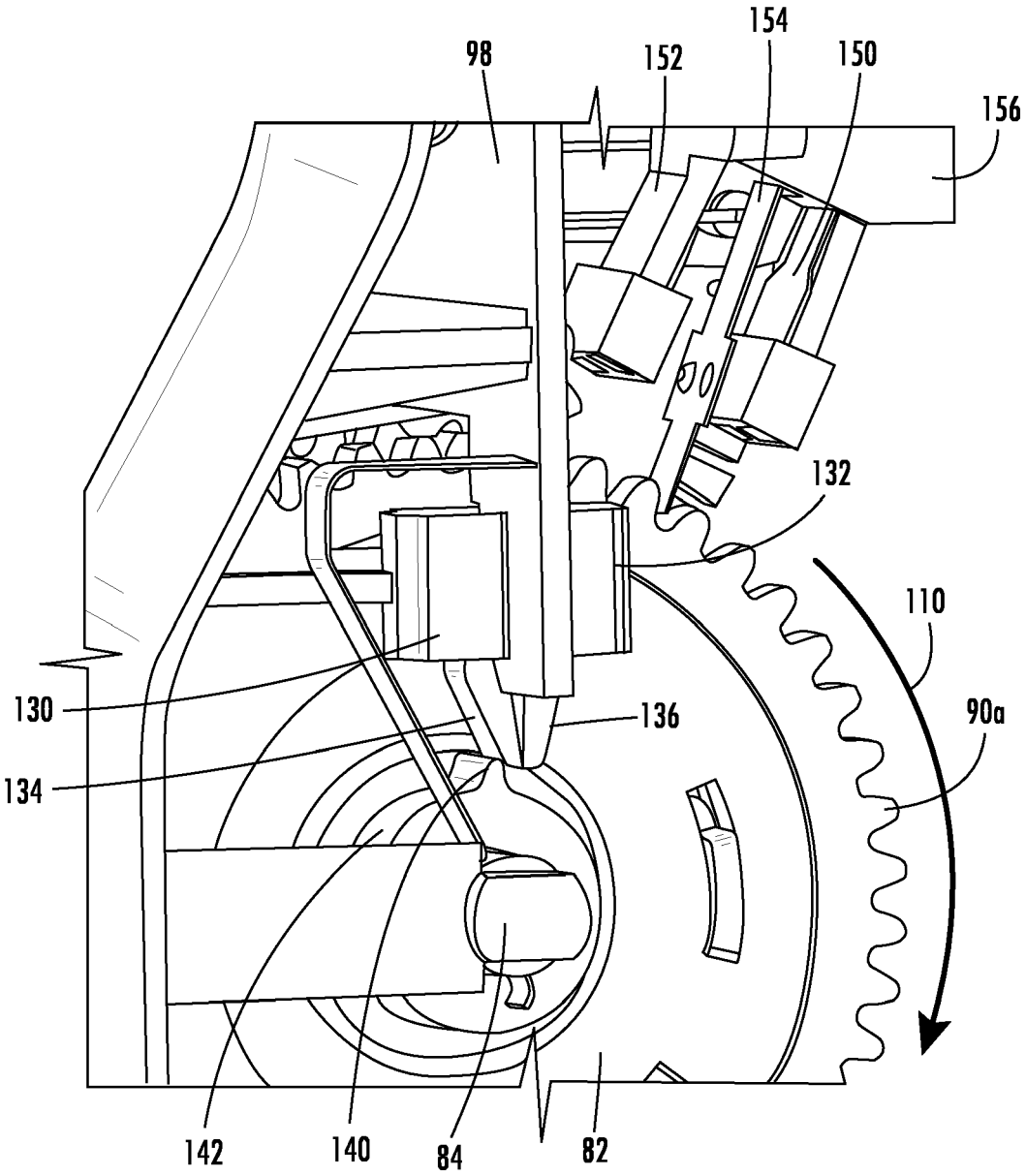

FIG. 6

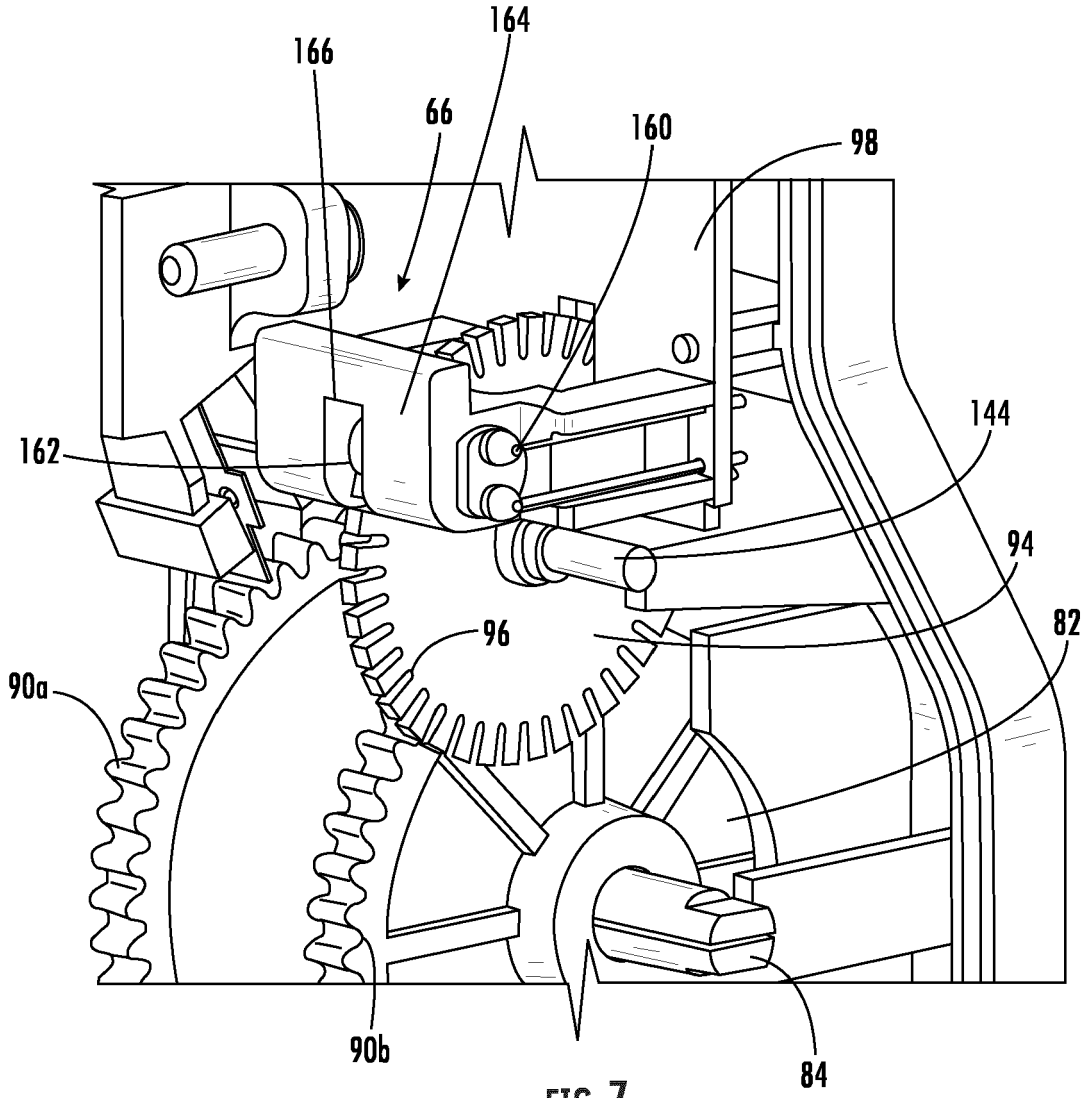

FIG. 7

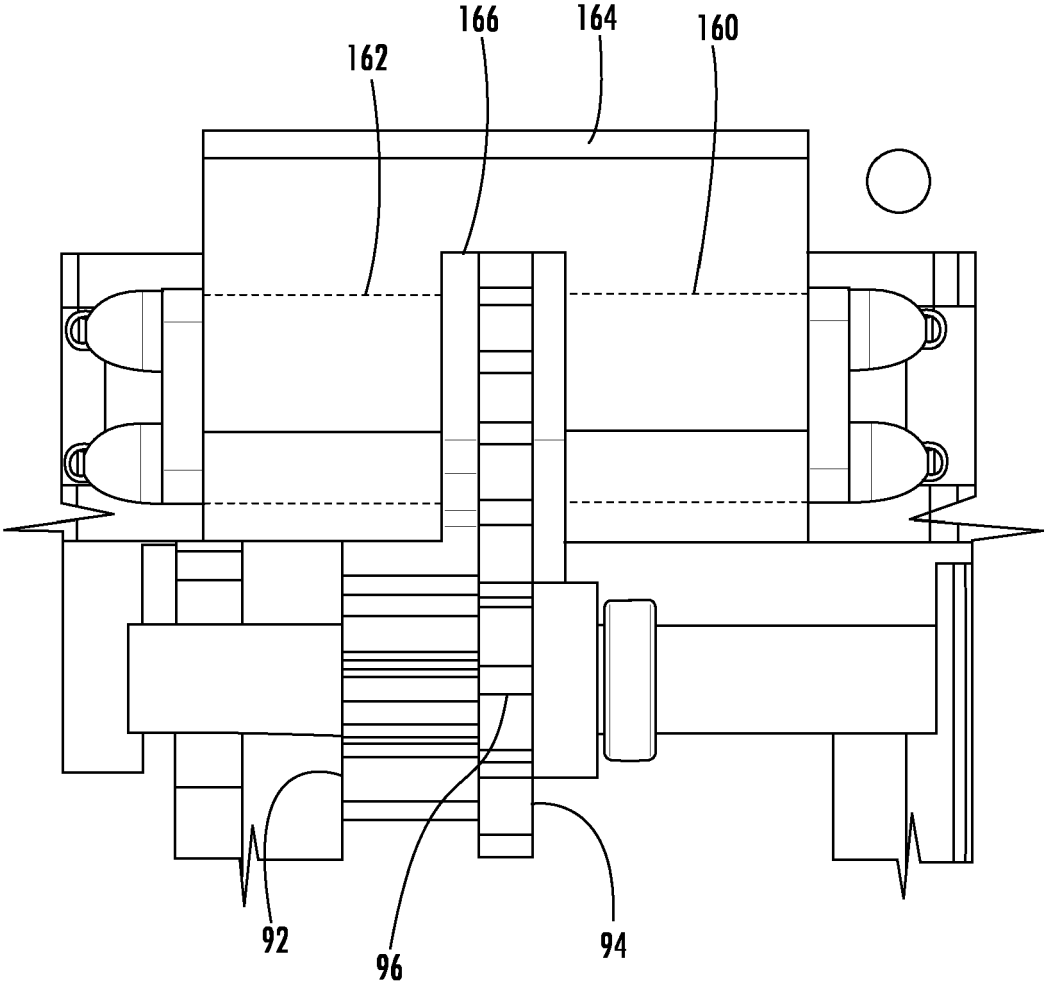

FIG. 8

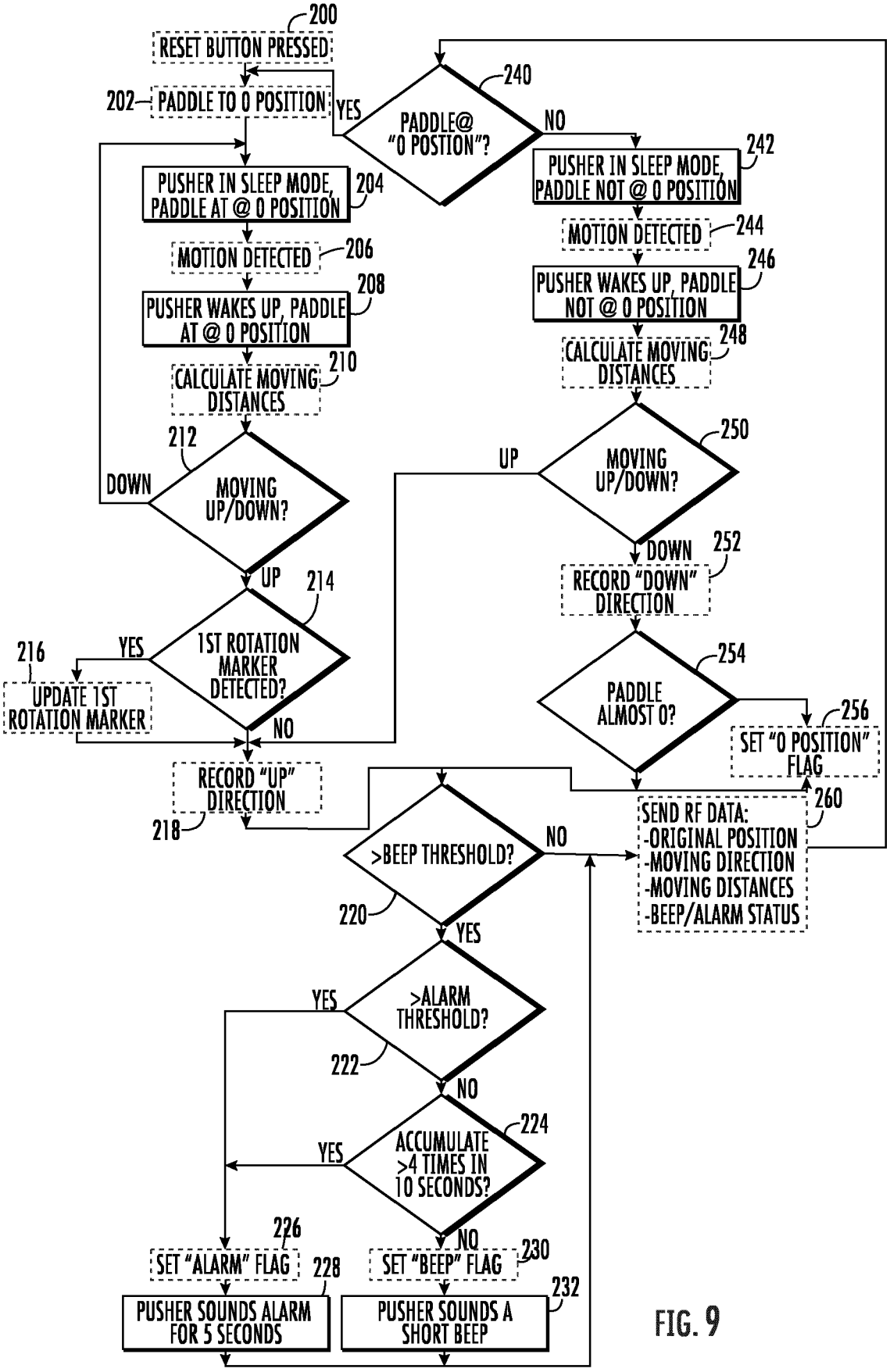
200
RESET BUTTON PRESSED
202
PADDLE TO 0 POSITION
YES
240
PADDLE@ "0 POSTION"?
NO
242
PUSHER IN SLEEP MODE, PADDLE NOT @ 0 POSITION
244
MOTION DETECTED
246
PUSHER WAKES UP, PADDLE NOT @ 0 POSITION
248
CALCULATE MOVING DISTANCES
250
MOVING UP/DOWN?
UP
DOWN
252
RECORD "DOWN" DIRECTION
254
PADDLE ALMOST 0?
256
SET "0 POSITION" FLAG
260
SEND RF DATA:
-ORIGINAL POSITION
-MOVING DIRECTION
-MOVING DISTANCES
-BEEP/ALARM STATUS
204
PUSHER IN SLEEP MODE, PADDLE AT @ 0 POSITION
206
MOTION DETECTED
208
PUSHER WAKES UP, PADDLE AT @ 0 POSITION
210
CALCULATE MOVING DISTANCES
212
MOVING UP/DOWN?
DOWN
UP
214
1ST ROTATION MARKER DETECTED?
YES
216
UPDATE 1ST ROTATION MARKER
NO
RECORD "UP" DIRECTION
218
>BEEP THRESHOLD?
NO
220
YES
>ALARM THRESHOLD?
YES
222
NO
ACCUMULATE >4 TIMES IN 10 SECONDS?
224
YES
NO
226
SET "ALARM" FLAG
228
PUSHER SOUNDS ALARM FOR 5 SECONDS
SET "BEEP" FLAG
230
PUSHER SOUNDS A SHORT BEEP
232

FIG. 9

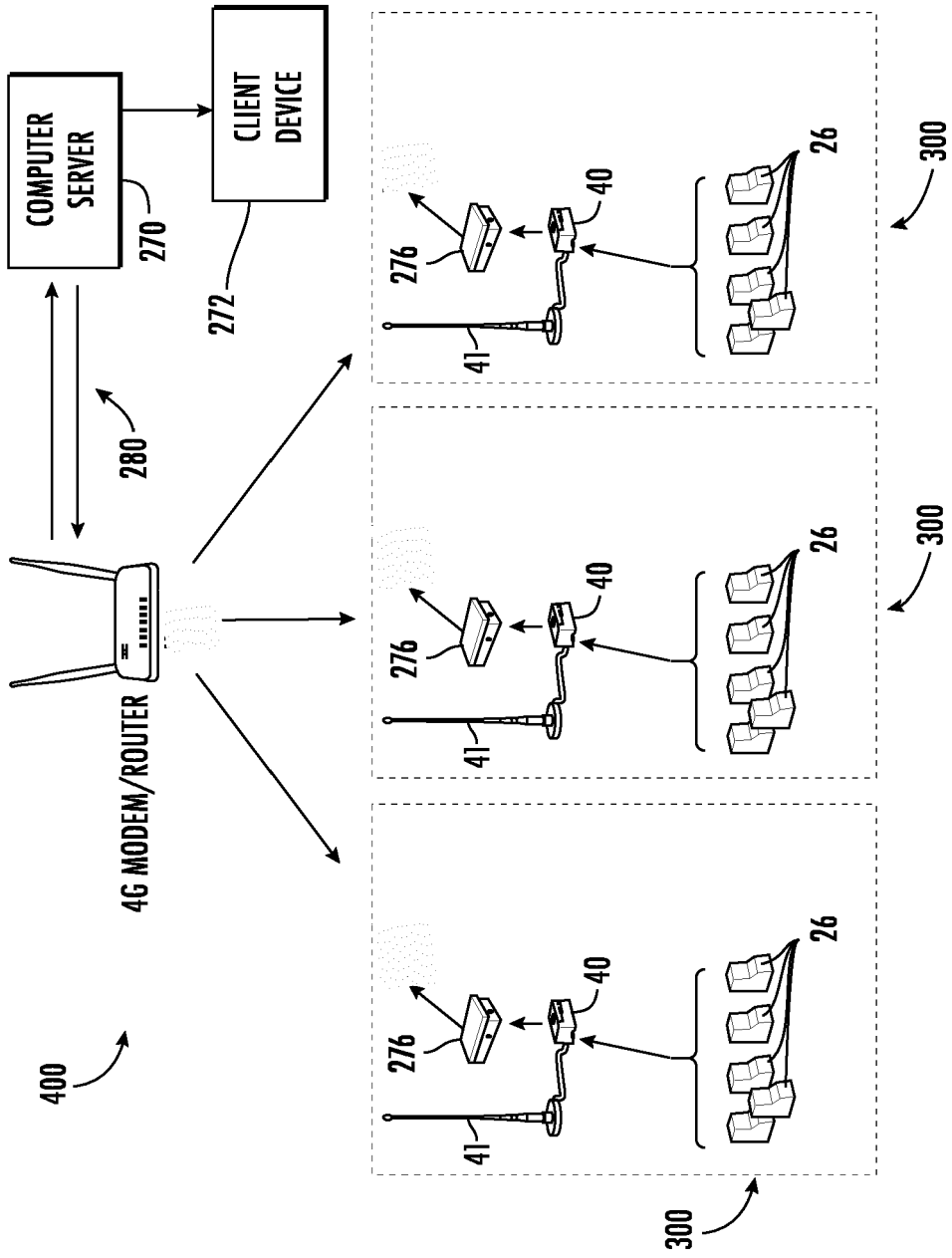
COMPUTER SERVER
270
CLIENT DEVICE
272
280
4G MODEM/ROUTER
400
300
300
300
276
40
41
26

FIG. 10

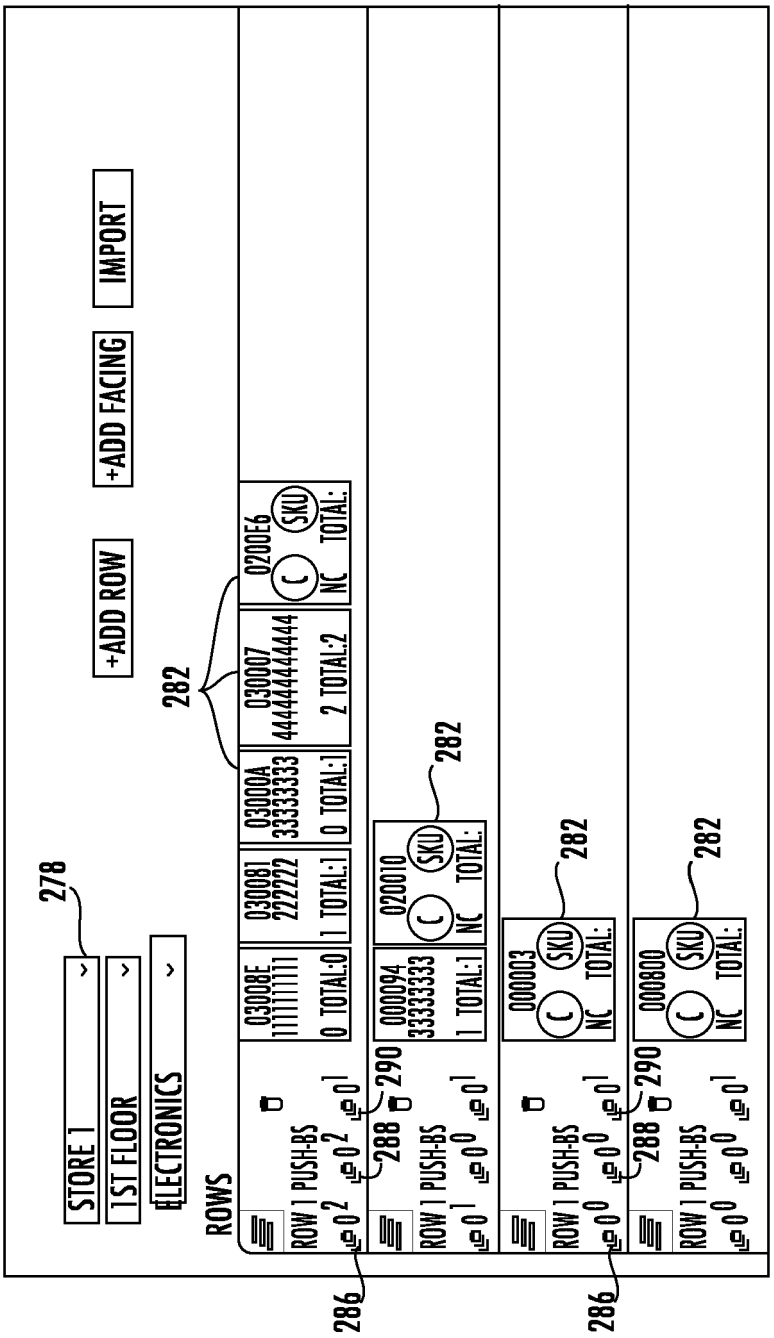
278
STORE 1
1ST FLOOR
ELECTRONICS
ROWS
+ADD ROW
+ADD FACING
IMPORT
282
030008E
1111111111
0 TOTAL:0
030081
222222
1 TOTAL:1
03000A
33333333
0 TOTAL:1
030007
444444444444
2 TOTAL:2
0200E6
C
SKU
NC
TOTAL:
000094
33333333
1 TOTAL:1
020010
000003
000800
ROW 1 PUSH-BS
288
290
286
284

FIG. 11

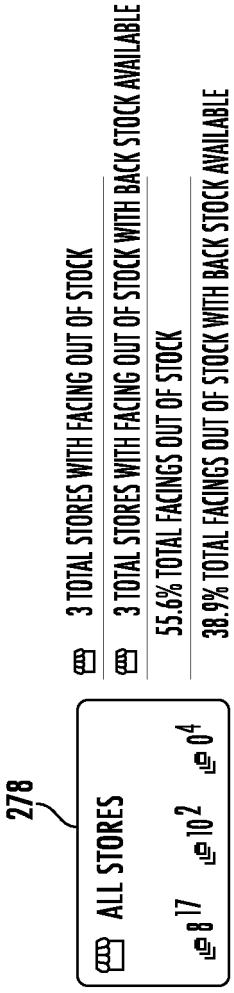
278
ALL STORES
8 17
10 2
0 4
3 TOTAL STORES WITH FACING OUT OF STOCK
3 TOTAL STORES WITH FACING OUT OF STOCK WITH BACK STOCK AVAILABLE
55.6% TOTAL FACINGS OUT OF STOCK
38.9% TOTAL FACINGS OUT OF STOCK WITH BACK STOCK AVAILABLE

FIG. 12

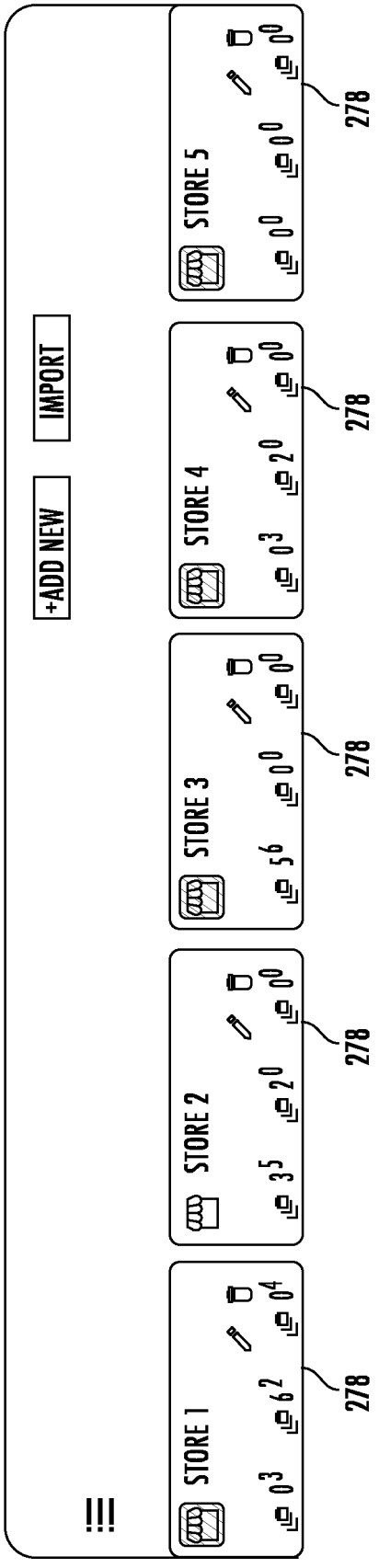
+ADD NEW
IMPORT
!!!
STORE 1
0 3
6 2
0 4
278
STORE 2
3 5
2 0
0 0
278
STORE 3
5 6
0 0
0 0
278
STORE 4
0 3
2 0
0 0
278
STORE 5
0 0
0 0
0 0
278

FIG. 13

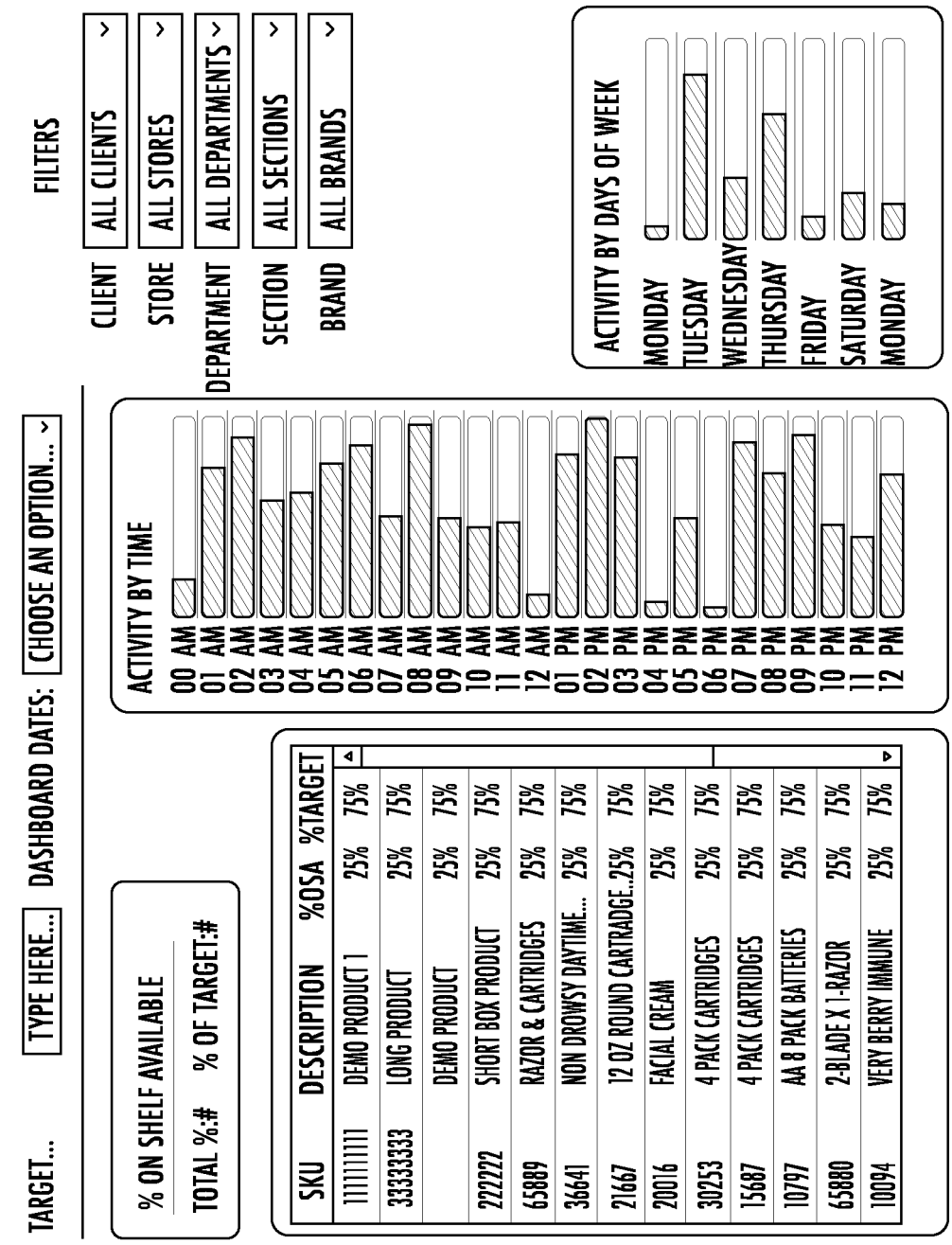
TARGET...
TYPE HERE...
DASHBOARD DATES:
CHOOSE AN OPTION...
FILTERS
CLIENT
ALL CLIENTS
STORE
ALL STORES
DEPARTMENT
ALL DEPARTMENTS
SECTION
ALL SECTIONS
BRAND
ALL BRANDS
% ON SHELF AVAILABLE
TOTAL %:# % OF TARGET:#
ACTIVITY BY TIME
00 AM
01 AM
02 AM
03 AM
04 AM
05 AM
06 AM
07 AM
08 AM
09 AM
10 AM
11 AM
12 AM
01 PM
02 PM
03 PM
04 PM
05 PM
06 PM
07 PM
08 PM
09 PM
10 PM
11 PM
12 PM
ACTIVITY BY DAYS OF WEEK
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
MONDAY
SKU DESCRIPTION %OSA %TARGET
1111111111 DEMO PRODUCT 1 25% 75%
33333333 LONG PRODUCT 25% 75%
DEMO PRODUCT 25% 75%
222222 SHORT BOX PRODUCT 25% 75%
65889 RAZOR & CARTRIDGES 25% 75%
36641 NON DROWSY DAYTIME... 25% 75%
21667 12 OZ ROUND CARTRADGE..25% 75%
20016 FACIAL CREAM 25% 75%
30253 4 PACK CARTRIDGES 25% 75%
15687 4 PACK CARTRIDGES 25% 75%
10797 AA 8 PACK BATTERIES 25% 75%
65880 2-BLADE X 1-RAZOR 25% 75%
10094 VERY BERRY IMMUNE 25% 75%

FIG. 14

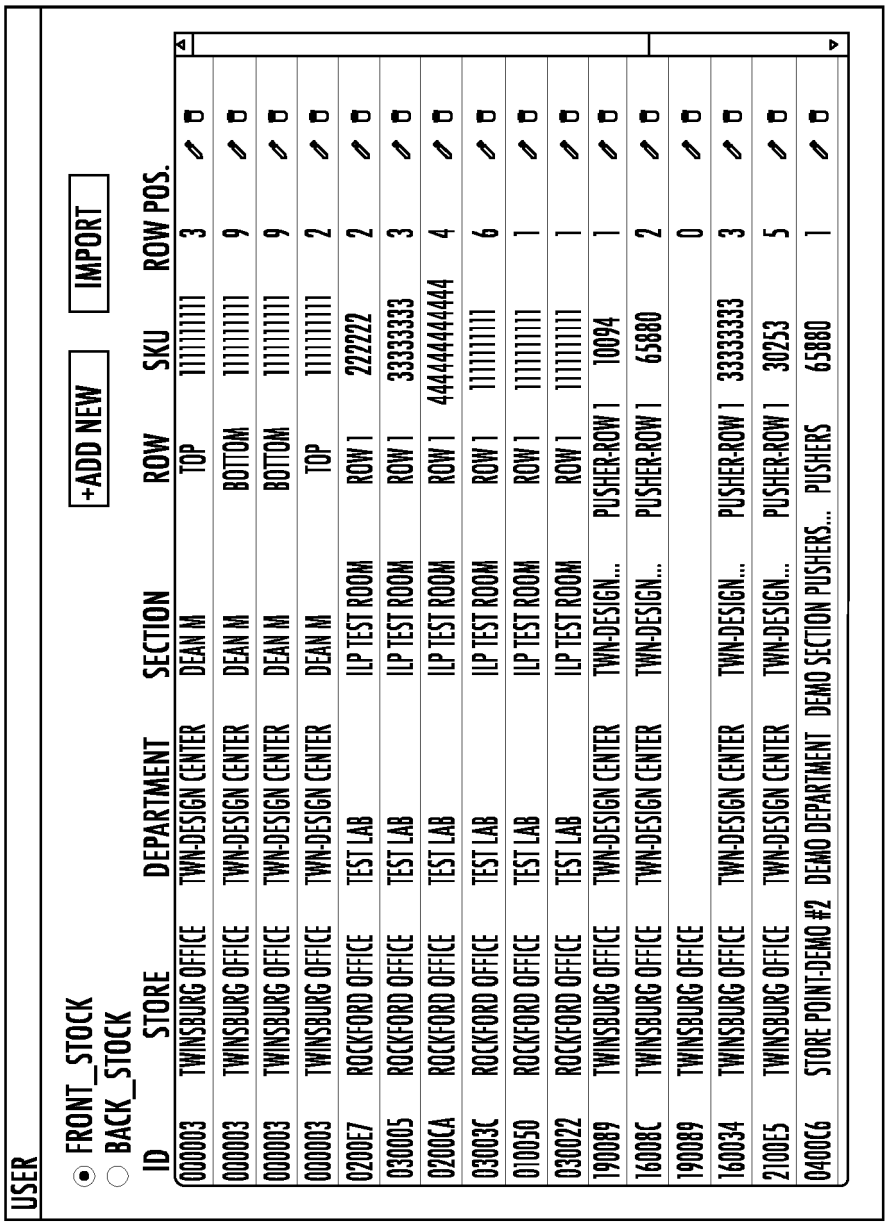
USER
FRONT_STOCK
BACK_STOCK
+ADD NEW
IMPORT
ID
STORE
DEPARTMENT
SECTION
ROW
SKU
ROW POS.
000003 TWINSBURG OFFICE TWN-DESIGN CENTER DEAN M TOP 1111111111 3
000003 TWINSBURG OFFICE TWN-DESIGN CENTER DEAN M BOTTOM 1111111111 9
000003 TWINSBURG OFFICE TWN-DESIGN CENTER DEAN M BOTTOM 1111111111 9
000003 TWINSBURG OFFICE TWN-DESIGN CENTER DEAN M TOP 1111111111 2
0200E7 ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 222222 2
030005 ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 33333333 3
0200CA ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 44444444444 4
03003C ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 1111111111 6
010050 ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 1111111111 1
030022 ROCKFORD OFFICE TEST LAB ILP TEST ROOM ROW 1 1111111111 1
190089 TWINSBURG OFFICE TWN-DESIGN CENTER TWN-DESIGN... PUSHER-ROW 1 10094 1
16008C TWINSBURG OFFICE TWN-DESIGN CENTER TWN-DESIGN... PUSHER-ROW 1 65880 2
190089 TWINSBURG OFFICE 0
160034 TWINSBURG OFFICE TWN-DESIGN CENTER TWN-DESIGN... PUSHER-ROW 1 33333333 3
2100E5 TWINSBURG OFFICE TWN-DESIGN CENTER TWN-DESIGN... PUSHER-ROW 1 30253 5
0400C6 STORE POINT-DEMO #2 DEMO DEPARTMENT DEMO SECTION PUSHERS... PUSHERS 65880 1

FIG. 15

+ADD NEW | IMPORT

ID	BRAND	PRODUCT DESCRIPTION	MODEL	QTY	QTY BACK STOCK
1111111111	ABC	DEMO PRODUCT 1	TEST-1	0	
3333333	XYZ	LONG PRODUCT	LONG	1	
4444444	ABC	DEMO PRODUCT	TEST-2	2	
222222	XYZ	SHORT BOX PRODUCT	SHORT	1	
5889	GILLETTE	RAZOR & CARTRIDGES	FUSION 5	2	
6641	EQUATE	NON DROWSY DAYTIME COLD & FLU	COLD & FLU	4	
1667	FORMULA	12 OZ ROUND CARTRIDGE	GOOD START	3	
0016	OLAY	FACIAL CREAM	RGENENRIST	5	
0253	GILLETTE	4 PACK CARTRIDGES	PROGLIDE	6	
5687	GILLETTE	4 PACK CARTRIDGES	FUSION 5	6	
0797	ENERGIZER	AA 8 PACK BATTERIES	AA-8	3	
5880	GILLETTE	2-BLADE X 1-RAZOR	PROGLIDE	2	
0094	AIRBORNE	VERY BERRY IMMUNE SUPPORT SUPPLIMENT	10-PACK BOTTLE	2	
23	123	123	123	6	
56	456	456	456	2	
78	678	678	678	5	

FIG. 16

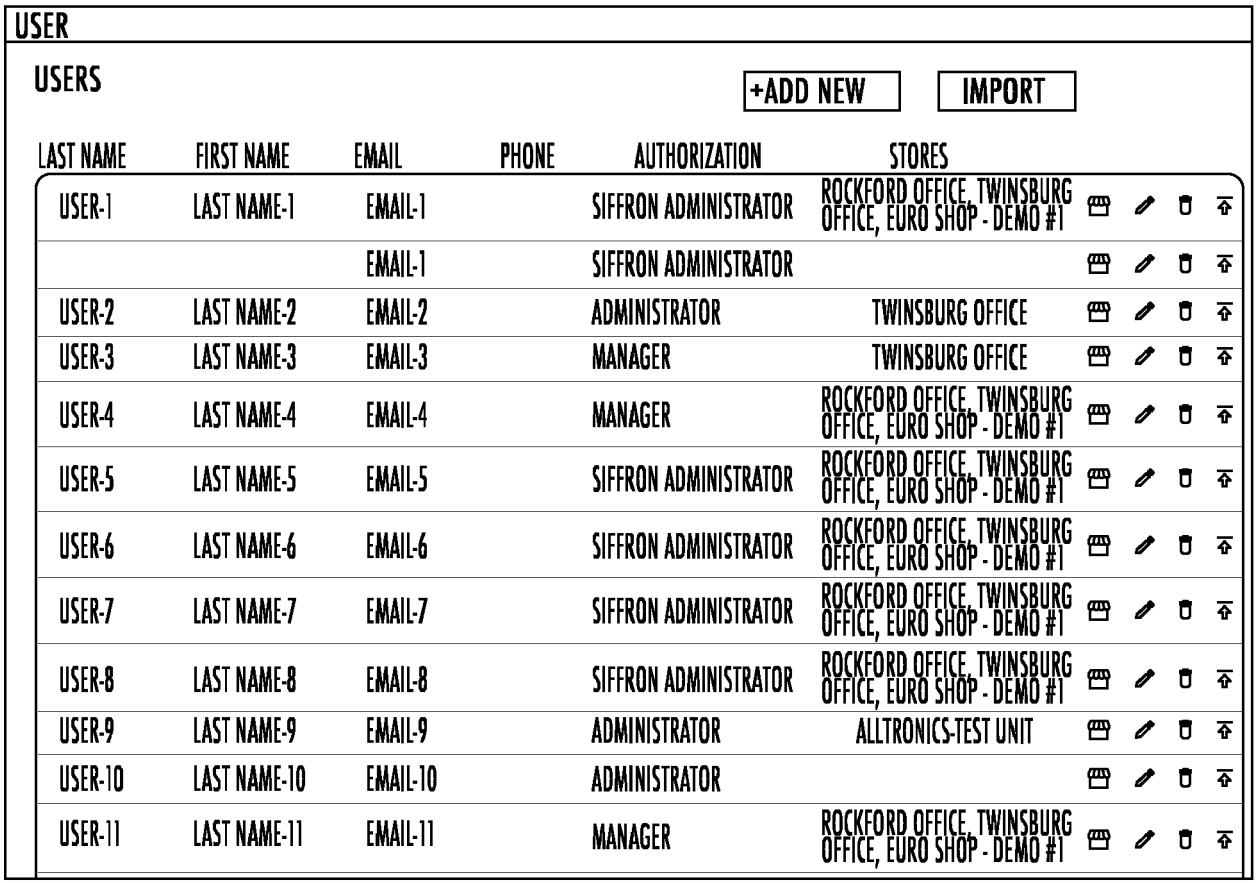
USER
USERS
+ADD NEW
IMPORT
LAST NAME
FIRST NAME
EMAIL
PHONE
AUTHORIZATION
STORES
USER-1
LAST NAME-1
EMAIL-1
SIFFRON ADMINISTRATOR
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
EMAIL-1
SIFFRON ADMINISTRATOR
USER-2
LAST NAME-2
EMAIL-2
ADMINISTRATOR
TWINSBURG OFFICE
USER-3
LAST NAME-3
EMAIL-3
MANAGER
TWINSBURG OFFICE
USER-4
LAST NAME-4
EMAIL-4
MANAGER
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
USER-5
LAST NAME-5
EMAIL-5
SIFFRON ADMINISTRATOR
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
USER-6
LAST NAME-6
EMAIL-6
SIFFRON ADMINISTRATOR
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
USER-7
LAST NAME-7
EMAIL-7
SIFFRON ADMINISTRATOR
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
USER-8
LAST NAME-8
EMAIL-8
SIFFRON ADMINISTRATOR
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1
USER-9
LAST NAME-9
EMAIL-9
ADMINISTRATOR
ALLTRONICS-TEST UNIT
USER-10
LAST NAME-10
EMAIL-10
ADMINISTRATOR
USER-11
LAST NAME-11
EMAIL-11
MANAGER
ROCKFORD OFFICE, TWINSBURG OFFICE, EURO SHOP - DEMO #1

FIG. 17

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 15 7917

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2020/315371 A1 (EWING BRENT O [US] ET AL) 8 October 2020 (2020-10-08) * paragraph [0003] - paragraph [0070]; claims 1-31; figures 1-7 * -----	1,5,6 2-4,7-20	INV. A47F1/12
Y	US 9 818 081 B2 (VERIZON PATENT & LICENSING INC [US]) 14 November 2017 (2017-11-14) * figures 7-9 * -----	2-4,7-20	

TECHNICAL FIELDS SEARCHED (IPC)

A47F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 June 2024	Kohler, Pierre

CATEGORY OF CITED DOCUMENTS

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21-06-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2020315371 A1	08-10-2020	AU 2020252550 A1	14-10-2021
		CN 113692241 A	23-11-2021
		EP 3945949 A1	09-02-2022
		US 2020315371 A1	08-10-2020
		US 2022240693 A1	04-08-2022
		US 2023301444 A1	28-09-2023
		WO 2020206300 A1	08-10-2020
US 9818081 B2	14-11-2017	NONE	

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Patent documents cited in the description

- US 72749622 **[0001]**
- US 83966720 **[0001]**
- US 11363894 B **[0001]**
- US 62830045 **[0001]**
- US 69753822 **[0001]**
- US 22042421 **[0001]**
- US 11317738 B **[0001]**
- US 29505619 **[0001]**
- US 10993550 B **[0001]**
- US 62646115 **[0001]**
- US 9254049 B **[0007]**
- US 9241583 B **[0007]**
- US 8720702 B **[0007]**