

Labor-Saving Showcase Reducing Operational Workload

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ABSTRACT

The advancement of population aging and declining birthrates in recent years has been increasing the need for labor savings in relation to showcases. To reduce the workload in operating showcases, three labor-saving items have been developed. Firstly, the easy-slide sloping shelf, which can be pulled out for stocking and easily put in a sloping position for display to simplify operation tasks. Secondly, the “swing rack,” which controls physically demanding tasks with movable racks that assist the transfer of heavy items when stocking products. Third, the showcase with a built-in cooling unit and equipped with an easy-filter-access mechanism that makes it easy to clean the condenser air filter.

1. Introduction

In recent years, the retail industry like other industries has been facing labor shortages and increasing labor costs due to the decreasing birthrate and aging population. As a result, it has been diversifying its workforce through the employment of senior citizens and overseas workers.

Personnel savings and labor savings are increasingly being demanded of items such as the showcases used in supermarkets and convenience stores in order to reduce workforces through increased productivity resulting from ease-of-use, decreased physical burdens and labor-saving operation.

To meet these demands, Fuji Electric has developed a labor-saving showcase. In this paper, we will describe the features of the showcase.

2. Overview of Personnel-Saving and Labor-Saving Items

We have recently developed three personnel-saving and labor-saving items focusing on customer requests and opinions, which include the desire to “shorten the time required to replenish products,” “shorten the time required to clean showcases” and “reduce the physical burden of carrying heavy objects when replenishing products.”

(1) Shortening the time required to replenish products

We have developed an easy-slide sloping shelf for displaying products on open showcases. This shelf is easy to operate and helps shorten the time required to replenish products.

(2) Simplifying showcase cleaning work

We have developed a mechanism for the condensers of showcases with built-in cooling unit that enables the air filter to be removed from the outside of the showcase. This simplifies filter cleaning duties.

(3) Reducing physical burdens when replenishing products

We have developed a “swing rack” that assists in product replenishment for walk-in cases. The swing rack is a movable shelf that attaches to the back of a walk-in rack inside the walk-in case. It is a labor-saving option for walk-in cases for which products are replenish from the back. It helps to reduce physical burdens.

3. Easy-Slide Sloping Shelf for Open Showcases

3.1 Challenges facing conventional structures

In conventional open showcases, consideration was given to three types of available shelves depending on the application. These were “fixed shelves,” “horizontal slide shelves” and “horizontal/sloping slide shelves” (enables switching between horizontal and sloped states).

In order to achieve labor-saving operation, there has been demands to replace all fixed shelves with slide shelves.

(1) Features of conventional slide shelf

(a) Enables shelves to be pulled out when replenishing products, thereby greatly reducing replenishing time.

(b) Enables shelves to be switched between horizontal state and sloped state. As a result, it diversifies the product display and sales floor layout, thereby helping to increase sales.

(2) Operational challenges of conventional slide shelf

(a) Does not enable shelves to be switched between

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horizontal state and sloped state when loaded with products. As shown in Fig. 1, since the switching mechanism is located at the back of the shelf, switching cannot be performed unless all the products are unloaded.

(b) Is difficult to switch between horizontal state and sloped state. As shown in Fig. 2, it is necessary to understand the switching mechanism

beforehand in order to perform the complicated operation of first moving a stepped screw along an irregularly shaped groove that is shaped like an arc and then fitting the other stepped screw into a hanging groove.

(c) Squeezes out the product display area due to the large size of the mechanism for switching between the horizontal and sloped state.

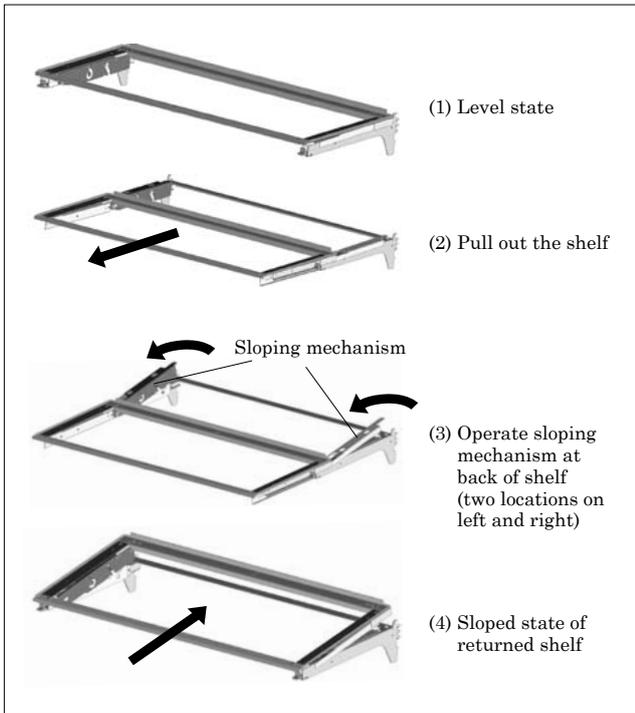


Fig.1 Procedure for switching between horizontal state and sloped state (Conventional configuration)

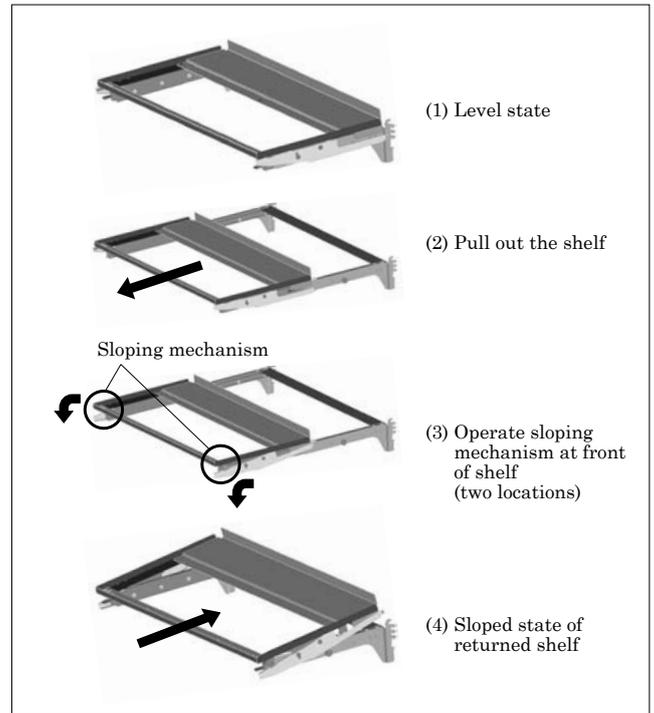


Fig.3 Procedure for switching between horizontal state and sloped state (new configuration)

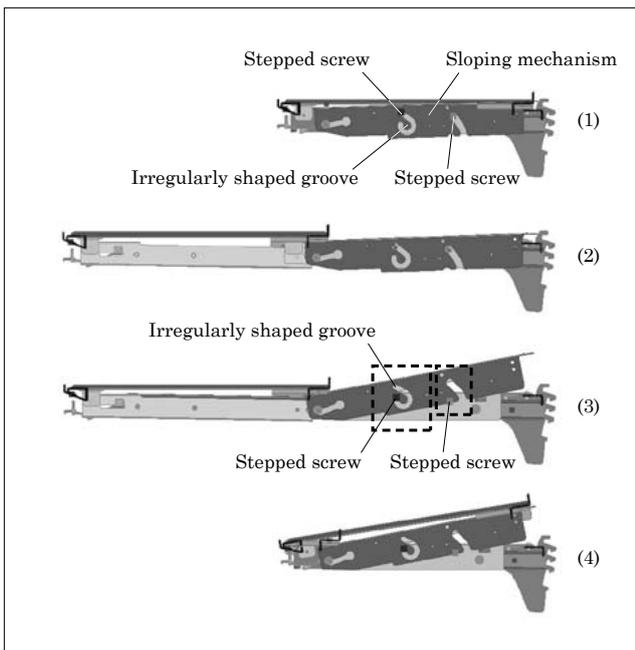


Fig.2 Mechanism for switching between horizontal state and sloped state (Conventional configuration)

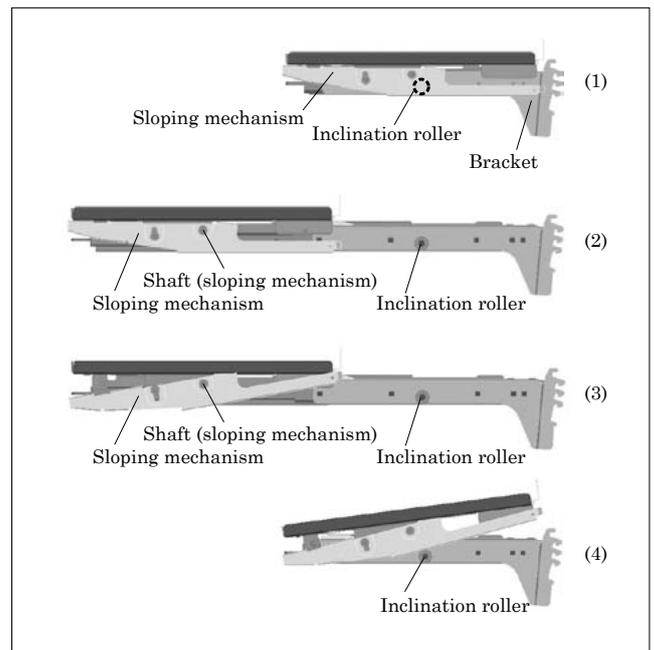


Fig.4 Mechanism for switching between horizontal state and sloped state (new configuration)

3.2 Features of easy-slide sloping shelf

In order to overcome these challenges, we developed the easy-slide sloping shelf as a product that reduces dead space (i.e., space where products cannot be displayed due to the large size of the switching mechanism) by 20%, while also making it easy to switch between the horizontal state and sloping state with loaded products.

We employed the following measures to achieve the development of the sloping shelf:

- (a) Moved the location of the mechanism for switching between the horizontal state and sloped state to the front of the shelf.
- (b) Made it possible to pull out the shelf and switch between states at the same time.
- (c) Placed the switching mechanism on the outside of the slide rail so that it does not interfere with the product display.

Figure 3 shows the procedure for switching between the horizontal state and sloped state with the easy-slide sloping shelf; and Fig. 4, the details of the new switching mechanism. As shown in Fig. 4, the sloping mechanism on the shelf side is designed to incline by running on the inclination roller. The sloping mechanism is designed to enable switching between the horizontal and sloped states by raising and lower-

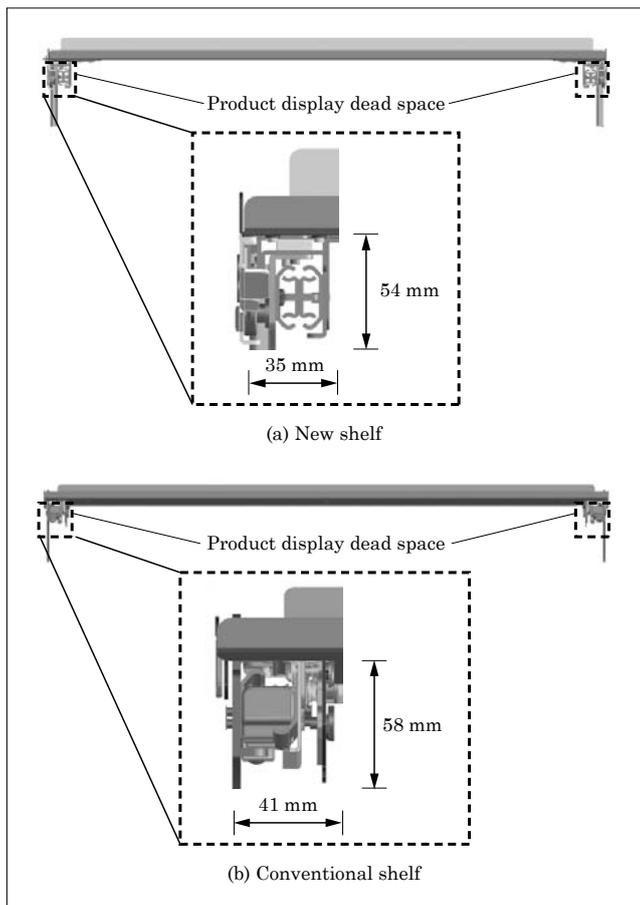


Fig.5 Comparison of sizes of sloping mechanisms

ing the shelf with the shaft (sloping mechanism) as a fulcrum while the shelf is pulled out. By adopting this new structure, it is now easy to switch between the horizontal and sloped states even when products are loaded on the shelf. This feature can reduce work time by 30 minutes a day.

In addition, the space-saving design of the sloping mechanism placed outside the slide rail, as shown in Fig. 5, reduces dead space by 20% when compared with conventional products.

4. Filter-Simple-Access Mechanism

Cleaning the condenser air filter (filter) is important for maintaining the performance of a showcase with built-in cooling unit. When the filter is 50% clogged, the efficiency of the cooling unit deteriorates and power consumption increases by approximately 20% (as measured in nutritional drink cases manufactured by Fuji Electric). To prevent this, we recommend that stores clean the filter once a week. In recent years, convenience stores have started to use more showcases with built-in cooling unit per store in order to accommodate the increase in sales of frozen foods. As a result, the workload for filter cleaning has also increased.

Conventionally, it was not possible to remove the filter for cleaning unless the cover of the condenser, called the kick plate, was detached from the unit, as shown in Fig. 6. Therefore, we developed a mechanism that enables the filter to be removed directly from the outside at the front of the showcase. Furthermore, since the filter is visible from the outside, anyone can easily check the status of the filter, thereby making it possible to suppress the increase in power consumption due to filter clogging.

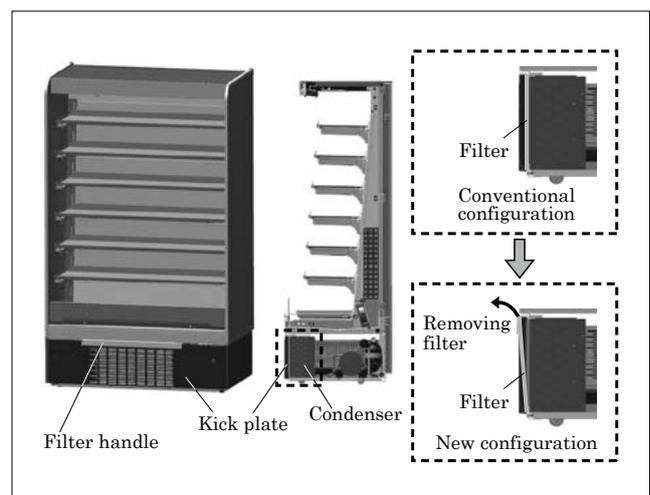


Fig.6 Filter mounting configuration

5. “Swing Rack”

Cans and plastic bottles are stored in cardboard beverage boxes until they are displayed in walk-in cases. Therefore, the physical burden of carrying heavy cardboard boxes (approximately 12 kg: twenty-four 500 ml plastic bottles) in and from the storage room and bending over repeatedly to replenish each product one-by-one from the cardboard boxes placed on the floor is by no means a small matter. We developed the swing rack as a product that attaches to walk-in racks in order to reduce this physical burden (see Fig. 7).

5.1 Ensuring shelf strength and establishing easy storability

We performed field tests to analyze the labor-saving effects and discover how store employees were working during actual use of the swing rack. The results showed that the supporting shelf of the swing rack was required to bear a single-load carrying capacity of three cardboard beverage boxes (totaling approximately 36 kg). Furthermore, in order to ensure safety, it was designed to hold up to 120 kg in consideration of unintended use such as loading it with heavy goods other than beverages and acts of mischief such as leaning on the supporting shelf of the swing rack (see Fig. 8).

Moreover, storage rooms are also used for temporarily storing refrigerated products in addition to cardboard beverage boxes. Therefore, the supporting shelf needed to be foldable when not being used for product replenishing work. Stopper mechanisms for the supporting shelf can cause injury, because they are likely to pinch fingers and hands when store staff folds the supporting shelf after having used it. Therefore, we used a ratchet type locking mechanism and damper mechanism shown in Fig. 9. This allows anyone to fold up the shelf safely and easily.

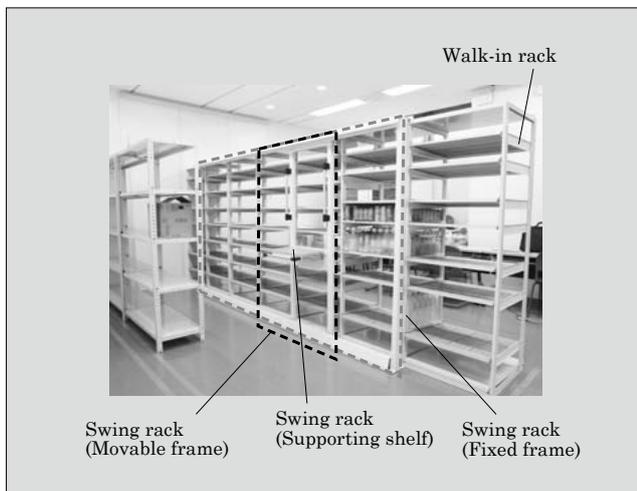


Fig.7 “Swing rack”

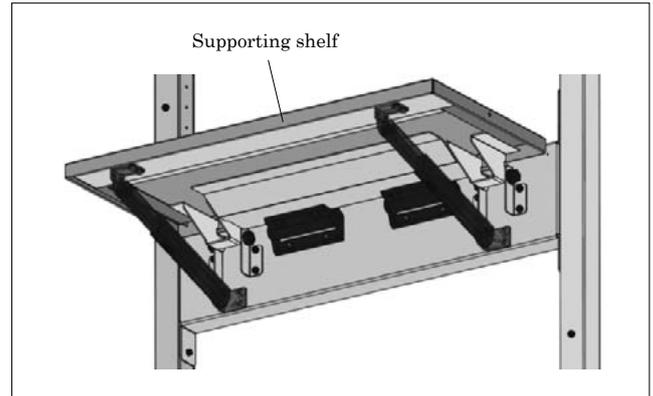


Fig.8 Detailed configuration of supporting shelf

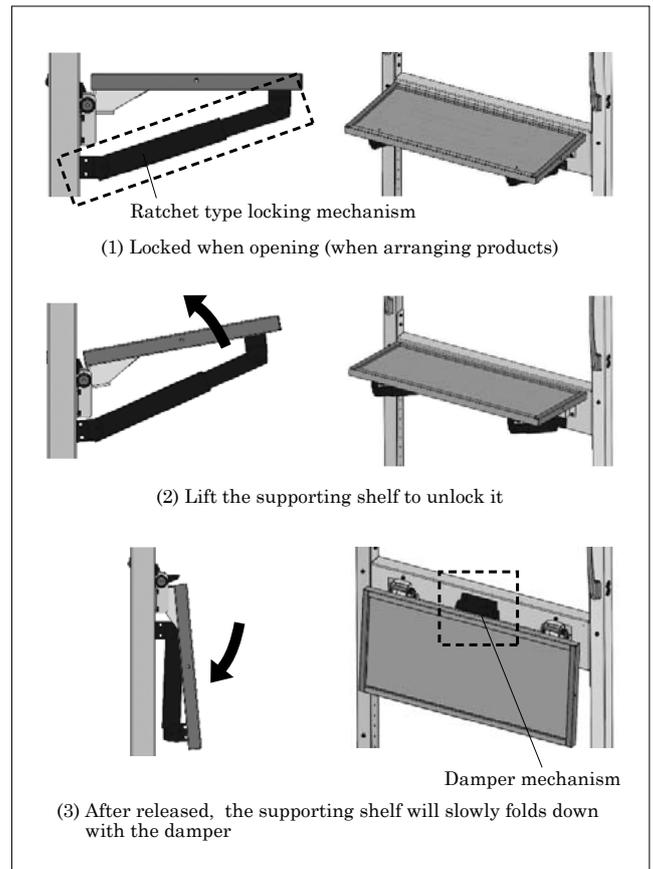


Fig.9 Opening and closing operation of a supporting shelf

5.2 Establishing durability and light operability for a movable frame

Figure 10 shows a movable frame in which a supporting shelf is mounted. The results of our field tests showed that movable frames need a durability that enables 25 round-trip uses a day for six walk-in doors for the whole seven year service life of the showcase [one round trip of 7.5 m × estimated 110,000 trips (twice the safety factor of seven years) = total distance of 861 km]. Furthermore, to make it easier to use for the elderly and women, it is necessary to minimize the movement operating force to 50 N or less. There-

fore, we mounted the bottom of the movable frame with a door rollers that move along a V-shaped rail as shown in Fig. 11. The V-shaped rail has the structure in which abrasion powder generated by the friction between the door rollers and rail, as well as dust from the storage room accumulate at the bottom of the rail groove. This structure helps reduce the friction resistance when the door rollers run up against dust.

When products are placed on the supporting shelf, a movement of force is generated that causes the movable frame to fall toward the front as shown in Fig. 12. Therefore, we provided guide rollers in the horizontal direction on the upper rail, allowing the movable frame to maintain its position and to be moved with small force.

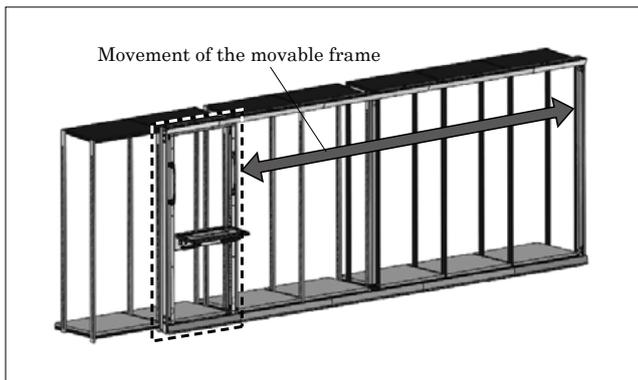


Fig.10 Movement of movable frame

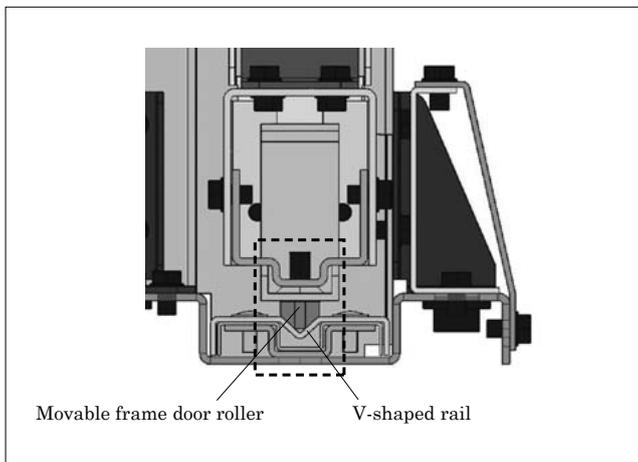


Fig.11 Door roller and V-shaped rail configuration (side view)

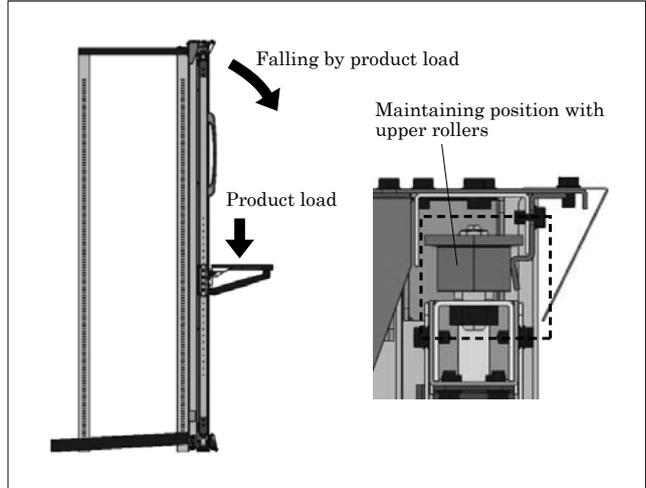


Fig.12 Maintaining position of movable frame with upper rollers (side view)

5.3 Easy installation in existing stores

The swing rack can be mounted to the walk-in racks of stores by modifying the racks on-site. When introducing it to an existing store, it requires additional processing on-site to be mounted on the walk-in racks of other manufacturers that have different dimensions in some degree. Therefore, in order to be mounted on all other manufacturers' products, it has the structure that the mounting position of parts can be changed according the external dimensions of various walk-in racks. Moreover, spacers and leveling devices can be mounted to it to ensure the levelness of the lower rail even when the surface of the storage room floor is uneven.

Using the swing rack allows store workers to reduce work time by 29 minutes a day and the number of times they bend over to perform work by 29 times a day.

6. Postscript

In this paper, we described our labor-saving showcase that reduces operation workloads. We expect that the need for personnel savings and labor savings will continue to increase in the retail industry. In this respect, we intend to continue engaging in developments that meet the needs of our customers.



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