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(71) Applicant:
**SANYO ELECTRIC Co., Ltd.
Moriguchi-shi, Osaka (JP)**

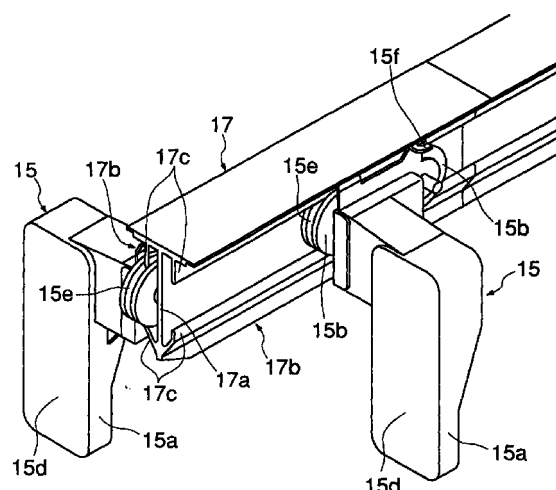
(72) Inventor: **Yasaka, Yoshio
Gunma-ken (JP)**

(74) Representative:
**Glawe, Delfs, Moll & Partner
Patentanwälte
Postfach 26 01 62
80058 München (DE)**

(54) **Article storage device for vending machine**

(57) There is provided an article storage device (1) for a vending machine. An article rack is provided within a body of the vending machine (2) in a manner such that the article rack (10) can be moved in a front-rear direction and drawn forward out of the body of the vending machine (2). The article rack (10) has an article passage (11) formed therein for receiving a large number of articles (5) one behind another. A rack opening/closing member (12) is provided at a front end of the article rack, for opening a dispensing opening of the article passage during a vending operation, and closing the dispensing opening except during the vending operation. A pusher (15) is inserted in said article passage, for pushing forward the articles received in the article passage. A guide member (17) is arranged above the article rack in a manner extending in the front-rear direction, for guiding the pusher in the front-rear direction. Urging means (30) urges the pusher forward. The article storage device is characterized in that the guide member comprises a body plate (15a) extending vertically, and a guide portion integrally formed with the body plate, the guide portion having a pair of guide protrusions laterally spaced from the body plate and being vertically opposed to each other, and the pusher comprises a pusher body inserted into the article passage, and a pair of front and rear rollers (15b) each formed with a U-shaped groove (15c) and attached to an upper side face of the pusher body in a manner rotatable about respective horizontal axes, the pusher being mounted between the vertically opposed guide protrusions of the guide portion of the guide member with the U-shaped grooves (15c) of the rollers being fitted on the vertically opposed guide protrusions.

FIG. 7



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to an article storage device for a vending machine, and more particularly to an article storage device of this kind which stores a large number of articles in a manner placed one after another, and pushes out the articles one by one by means of a pusher to dispense them for vending.

Prior Art

[0002] The present applicant proposed this kind of article storage device for a vending machine e.g. in Japanese Patent Application No. 9-69211. As shown in FIGS. 13 and 14, the article storage device 50 includes a plurality of article racks 51 arranged one above another, each of which is formed with a pair of right and left article passages 52. Article S are stored in these article passages 52. Each article rack 51 is mounted in a body of the vending machine, not shown, such that it can be moved in a front-rear direction by means of rollers 53, ball bearings 54, etc. and that it can be drawn out of the machine body.

[0003] Further, the article rack 51 has a rack opening/closing plate 55 mounted at a front end thereof for opening/closing the article passage 52, and a pair of pushers 56 each movably mounted behind the rack opening/closing plate 55 in a manner corresponding to the respective article passages 52. A large number of articles S are stored in the article passages 52 in a manner placed one after another between the rack opening/closing plate 55 and each of the pushers 56. The pushers 56 are each slidably mounted on a guide rod 57 arranged in a front-rear direction under an upper article rack 51. While the pusher 56 can slide forward and backward along the guide rod 57, it is always urged forward by helical tension springs 59 connected thereto by a wire 58, etc.

[0004] According to the above construction, when the article storage device 50 is to be replenished with articles S, an article rack requiring the replenishment is drawn forward out of the machine body, and then the articles S are placed one after another in each article passage 52 with the pushers 56 being held within the machine body. After the replenishment, the article rack 51 is pushed back into the machine body, whereby each of the pushers 56 is pushed by a rearmost one of the articles S placed in the article passage 52 to be moved back to its predetermined backward position. In this state, the numerous articles S in the article passage 52 are sandwiched between the rack opening/closing plate 55 in its closed position and a corresponding one of the pushers 56 urged forward by the helical tension springs 59. During a vending operation, the rack opening/clos-

ing plate 55 opens one of the article passages 52 to dispense a foremost one of the articles S therefrom.

[0005] However, there is room for improvement in the above article storage device 50 to ensure smooth movement of the pushers 56. That is, in this article storage device 50, each pusher 56 is supported by a corresponding guide rod 57 in a manner hung therefrom, and hence the pusher 56 is brought into contact with the rearmost article S at a lower point than a supporting point at which the pusher 56 is supported by the guide rod 57. Therefore, moment which acts on a lower portion of the pusher 56 to turn the pusher 56 backward about the supporting point is produced by a reaction force from the rearmost article S generated when the pusher 56 pushes the articles S forward, and by an urging force applied via the articles S to the pusher 56 when the article rack 51 is pushed back after being replenished. This causes the pusher 56 to be inclined with respect to the guide rod 57, whereby sliding (frictional) resistance to the movement of the pusher 56 on the guide rod 57 is increased.

[0006] Then the pusher 56 pushes relatively light articles S, the sliding resistance is not significant so that no serious problem occurs. However, when articles S are heavy, or when frictional resistance between articles S and the article passage 52 is high, the sliding resistance between the pusher 56 and the guide rod 57 is much increased, causing a large loss of the urging force of the pusher 56. This demands a large urging force of the helical tension springs 59 for pushing the articles S forward for delivery. However, if the urging force of the helical tension springs 59 is increased, it causes an increase in resistance produced when the article rack 51 is pushed back into the machine body after being replenished with articles S. This seriously affects ease of handling of the article rack 51. Further, when the article rack is pushed back, the urging force of the articles S acts on the pusher 56 to increase the inclination of the pusher 56 with respect to the guide rod 57. As a result, the sliding resistance between the pusher 56 and the guide rod 57 is increased, causing a large loss of operating force and hence also affecting the ease of handling of the article rack 51. Moreover, the guide rod 57 is very thin and long, and cannot avoid sagging to some degree, which also causes an increase in the sliding resistance of the pusher 56 on the rod 57.

SUMMARY OF THE INVENTION

[0007] It is an object of the invention to provide an article storage device for a vending machine having a construction which is capable of reducing frictional resistance of a pusher to near zero, thereby making it possible to reduce the urging force required for moving the pusher forward and enhance ease of handling of an article rack in which the pusher is inserted for pushing articles.

[0008] To attain the above object, the present inven-

tion provides an article storage device for a vending machine, including an article rack provided within a body of the vending machine in a manner such that the article rack can be moved in a front-rear direction and drawn forward out of the body of the vending machine, the article rack having an article passage formed therein for receiving a large number of articles one behind another, a rack opening/closing member provided at a front end of the article rack, for opening a dispensing opening of the article passage during a vending operation, and closing the dispensing opening except during the vending operation, a pusher inserted in the article passage, for pushing forward the articles received in the article passage, a guide member arranged above the article rack in a manner such that the guide member extends in the front-rear direction, for guiding the pusher in the front-rear direction, and urging means for urging the pusher forward.

[0009] The article storage device according to the invention is characterized in that the guide member comprises a body plate extending vertically, and a guide portion integrally formed with the body plate, the guide portion having a pair of guide protrusions laterally spaced from the body plate and being vertically opposed to each other, and the pusher comprises a pusher body inserted into the article passage, and a pair of front and rear rollers each formed with a U-shaped groove and attached to an upper side of the pusher body in a manner rotatable about respective horizontal axes, the pusher being mounted between the vertically opposed guide protrusions of the guide portion of the guide member, with the U-shaped groove of each of the rollers being fitted on the vertically opposed guide protrusions.

[0010] According to this article storage device for a vending machine, when the article rack is to be replenished with articles, it is drawn forward out of the machine body, and then the articles are placed one behind another in the article passage in a state of the pusher being held within the machine body. After the replenishment, the article rack is pushed back into the machine body, whereby a rearmost one of the articles placed in the article passage pushes the pusher back to its extreme backward position. Thus, the numerous articles are made ready for vending in a state sandwiched between the rack opening/closing member in its closed position and the pusher body of the pusher urged forward by the urging means. During a vending operation, the rack opening/closing member opens the dispensing opening of the article passage, whereby a foremost one of the articles placed in the article passage is dispensed from the article rack.

[0011] As described above, the pusher moves backward along the guide member after replenishment of articles, with the pusher body thereof being pushed by the articles in the article passage, while it moves forward along the guide member during a vending operation, with the pusher body pushing the articles. In these

cases, according to the invention, the pair of front and rear rollers mounted on the pusher body roll on the guide member, so that moment produced by a pushing force applied between the pusher body and the articles to act on the pusher body is absorbed by the rollers, whereby frictional resistance to the movement of the pusher on the guide member is considerably reduced. As a result, the urging force of the urging means required for moving the pusher forward can be reduced, which makes it possible to enhance ease of handling of the article rack after replenishment of articles.

[0012] Further, since each of the rollers is mounted on the guide member in a manner rotatable about its horizontal axis and rolls in a state of the U-shaped groove thereof being engaged with the upper and lower guide protrusions, it is possible to employ a guide member having a smaller width (or side-to-side dimension) compared with a case in which the whole of each roller is received in the guide member. When the article rack has two article passage formed therein, the guide member can also serve as a partition wall for separating the upper spaces of the article passage from each other, so that the guide member having a reduced width allows larger space to be used for storing articles.

[0013] Preferably, each of the rollers is equipped with a bearing.

[0014] According to this preferred embodiment, direct torque transmission between each of the rollers and its rotational shaft is prevented by the bearing, and frictional resistance produced between them during rotation of the roller is reduced to near zero, whereby the frictional resistance to the movement of the pusher on the guide member is further reduced.

[0015] Preferably, the pusher further comprises an auxiliary roller mounted on the pusher body at a location below the rollers, for rotation about a vertical axis of the auxiliary roller to roll on a side face of the body plate of the guide member.

[0016] According to this preferred embodiment, the auxiliary roller mounted on a lower side face of the pusher body rolls about its vertical axis to move on the body plate of the guide member in rolling contact therewith. Therefore, the urging force of the pusher body in contact with the articles can maintain perpendicularity with respect to a plane in which the guide member extends, whereby the frictional resistance to the movement of the pusher can be further decreased.

[0017] Preferably, the guide member is made of an extrusion molded article of aluminum.

[0018] According to this preferred embodiment, the guide member can have an increased strength and dimensional accuracy. The increased dimensional accuracy contributes to further reduction of the frictional resistance to the movement of the pusher on the guide member.

[0019] Preferably, the guide member is subjected to surface treatment by using alumite.

[0020] According to this preferred embodiment, the

smoothness of the guide member is enhanced, whereby the frictional resistance to the movement of the pusher on the guide member is further decreased.

[0021] The above and other objects, features, and advantages of the invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a front view of a vending machine incorporating an article storage device according to an embodiment of the invention;

FIG. 2 is a front view of the FIG. 1 vending machine in a door-opened state;

FIG. 3 is a sectional side elevation of the FIG. 1 vending machine;

FIG. 4 is a perspective view showing an article rack drawn out of a body of the FIG. 1 vending machine;

FIG. 5 is an enlarged partial front view showing a portion encircled by a broken line indicated by an arrow A in FIG. 2;

FIG. 6 is a perspective view of a rack opening/closing mechanism of the article storage device;

FIG. 7 is a perspective view showing pushers and a guide rail associated therewith;

FIG. 8 is a perspective view of one of two drive mechanisms arranged on a shelf in parallel with each other;

FIG. 9 is a side elevation showing the construction of the drive mechanism;

FIG. 10A is a perspective view showing the construction of the drive mechanism;

FIG. 10B is an enlarged partial perspective view of FIG. 10A;

FIG. 11 is a plan view showing the drive mechanisms in a state of the pushers being held in their respective extreme forward positions;

FIG. 12 is a plan view showing the drive mechanisms in a state of the pushers being held in their respective extreme backward positions;

FIG. 13 is a perspective view showing a pusher and a guide mechanism for the pusher used in a conventional article storage device proposed by the present applicant; and

FIG. 14 is an enlarged partial front view of the article storage device including the FIG. 13 components.

DETAILED DESCRIPTION

[0023] The invention will now be described in detail with reference to drawings showing an embodiment thereof. Referring first to FIGS. 1 to 3, a vending machine 2 to which the present invention is applied is a so-called see-through vending machine which allows

vendible articles actually contained therein, such as canned or packed beverages, to be viewed from outside. The vending machine 2 is comprised of a machine body 3 having an article storage device 1 of the invention installed therein, a main door 4 mounted on the front of the machine body 3, and a transparent heat insulating door 5 interposed between the main door 4 and the machine body 3.

[0024] As shown in FIGS. 2 and 3, mounted in a storage box 3a of the machine body 3 are twenty four article racks 10 which are arranged in eight vertical layers and three horizontal rows. Each of the article racks 10 stores articles S of the same kind. On the front of the main door 4, there are arranged a plurality of slots 4a, a plurality of product selection buttons 4b, a product outlet 4c, and a front window 4d for allowing vendible articles to be viewed from outside to serve as a product display. The selection buttons 4b each having a number identical to one assigned to a corresponding one of the article racks 10 are arranged in the form of a matrix corresponding to the array of the article racks 10. This construction permits viewing of the articles S in the article racks 10 through the front window 4d and the transparent heat insulating door 5. A user can select and buy a desired article S by putting cash into any one of the slots 4a and then pushing a selection button 4b corresponding to an article rack 10 storing the desired article.

[0025] Within the machine body 3, there are arranged a plurality of shelves 16 (see FIG. 5), and each of the article racks 10 is mounted on a corresponding one of the shelves 16 such that it can move in a front-rear direction thereon. Each article rack 10 is received in the machine body 3, as shown in FIG. 3, when the machine 1 is ready for vending the articles S. On the other hand, when the rack 10 is required to be replenished with articles S, it is drawn forward out of the machine body 3 as shown in FIG. 4. As shown in FIGS. 4 and 5, each of the article racks 10 is formed with a pair of right and left article passage 11, 11 extending in parallel with each other in a front-rear direction. In each of the article passage 11, 11, a large number of articles S of the same kind are placed one behind another in a horizontal row each in an upright position. The storage box 3a has an elevator 6 arranged in a space in front of the array of article racks 10 such that the elevator 6 can move up and down between the ceiling of the storage box 3a and a shutter 3b arranged on the bottom of the same. The elevator 6 carries an article S dispensed from one of the article passages 11 on a carrier plate 6a down to the vicinity of the shutter 3b, and delivers the article S via the shutter 3b and the product outlet 4c.

[0026] Further, as shown in FIGS. 4 to 6, each of the article racks 10 has a front end thereof provided with a rack opening/closing mechanism 7 for opening/closing the article passage 11. The rack opening/closing mechanism 7 is comprised of a pair of right and left rack opening/closing plates (rack opening/closing members) 12, 12, a spring, not shown, and an stopper plate 9

mounted in front of the pair of rack opening/closing plates 12 in a manner slidable on front surfaces thereof. Each of the rack opening/closing plates 12, which is formed of a transparent synthetic resin (e.g. polycarbonate), has a semicircular cut-away portion formed by cutting away a lower inside portion of the plate 12, and a semicircular protrusion 12a formed along the cut-away portion. Further, the rack opening/closing plates 12 are each mounted at the extreme front end of a corresponding one of the article racks 10 such that it can pivot about inside end portions thereof serving as a vertical axis of the plate 12. The rack opening/closing plate 12 can pivotally move between a closed position thereof for closing a dispensing opening 11a of a corresponding one of the article passage 11 and an open position thereof for opening the same. The rack opening/closing plates 12 are always urged by the spring in a rack opening direction (indicated by an arrow B in FIG. 6). The stopper plate 9 formed by a circular plate of an opaque synthetic resin (e.g. polyacetal) is fixed to an end of a drive shaft 9a extending in a manner concentric with a circle formed by the semicircular protrusions 12a of the rack opening/closing plates 12. The drive shaft 9a is connected to an stopper plate drive mechanism 13 (see FIG. 8), for being driven for rotation.

[0027] In the construction described above, when articles S are ready for vending, the stopper plate 9 is held at an abutment position shown in FIG. 5 and 6 in which the stopper plate 9 is in abutment with the protrusions 12a, 12a of the rack opening/closing plates 12, 12 whereby the plates 12 are each held in its closed position. In this state, a foremost one of the vendible articles S received in each article passage 11 is in abutment with a corresponding one of the plates 12 in its closed position, whereby all the articles S in the article passage 11 are prevented from advancing. On the other hand, when an article S is to be delivered for vending, the drive shaft 9a is driven by the stopper plate drive mechanism 13 for rotation through a predetermined angle, whereby the stopper plate 9 is rotated and shifted to one side by sliding on the protrusions 12a of the rack opening/closing plates 12, to thereby release one of the plates 12 on an opposite side to the direction of the movement of the stopper plate 9. As a result, the released plate 12 is pivotally moved by the urging force of the spring to its open position for opening the dispensing opening 11a of a corresponding one of the article passage 11 to dispense the article S therefrom. Reference numeral 14 indicates a blocking plate which projects itself in a manner interlocked with rotation of the drive shaft 9a for blocking a second article S to be sold next time from being dispensed together with the article S sold this time.

[0028] Further, as shown in FIGS. 5 and 7, the article racks 10 are each provided with a pair of right and left pushers 15, 15 for each pushing forward the articles S in a corresponding one of the article passages 11 to dispense the same for vending, and a guide rail 17 for

guiding the pushers 15, 15 along opposite side faces thereof, respectively.

[0029] The guide rail 17 is mounted at a central portion of the underside of a corresponding upper shelf 16 immediately above the present shelf 16 in a manner extending in a front-rear direction and at the same time protruding downward. Accordingly, the guide rail 17 also serves as a partition wall for separating upper spaces of the respective article passage 11, 11 from each other.

The guide rail 17 is comprised of a body plate 17a extending vertically, and a pair of right and left guide portions 17b, 17b integrally formed with the body plate 17a at opposite side faces of the body plate 17a, respectively. Each guide portion 17b is comprised of a pair of upper and lower guide protrusions 17c, 17c formed such that the upper guide protrusion 17c protrudes downward from a horizontal portion extending laterally from a top of the body plate 17a, and that the lower guide protrusion 17c extends laterally and obliquely from a bottom of the body plate 17c and then protrudes upward in a manner opposed to the upper guide protrusion 17c. The guide rail 17 is formed e.g. by an extrusion molded article of aluminum which is subjected to surface treatment by using alumite.

[0030] The pushers 15 are each comprised of a pusher body 15a inserted into a corresponding one of the article passages 11, for urging the articles S forward along the corresponding article passage 11, a pair of front and rear rollers 15b, 15b mounted on an upper side face of the pusher body 15a, and an auxiliary roller 15c mounted on a lower side face of the same. The pusher body 15a is in the form of a block made of a synthetic resin (e.g. polypropylene) and having a front surface serving as a flat urging face 15d for urging articles S forward.

[0031] The rollers 15b are each equipped with a bearing, not shown, and mounted on the upper side face of the pusher body 15a such that each of them is capable of rolling about its horizontal axis. Each of the rollers 15b has a peripheral surface formed with a V-shaped groove 15e, and is mounted in the guide rail 17 in a state of the V-shaped groove 15e being fitted on the upper and lower guide protrusions 17c, 17c of the guide rail 17. This construction enables the respective rollers 15b to roll along the guide rail 17 with extremely small frictional resistance to move the pusher 15 forward and backward smoothly.

[0032] The U-shaped groove 15e is formed such that the distance between two bottom points thereof diametrically opposite to each other is e.g. 19.5 mm, while the distance between the upper and lower guide protrusions 17c, 17c is set to e.g. 20.0 mm. i.e. a value slightly larger than that between the two diametrically opposite bottom points of the U-shaped groove 15e. This dimensional relationship between the U-shaped groove 15e and the upper and lower guide protrusions 17c, 17c makes it possible to prevent the rollers 15b from coming off the guide rail 17. Further, the pair of rollers 15b, 15b

are arranged such that an imaginary line connecting between their rotational axes is slightly inclined with respect to another imaginary line perpendicular to the urging face 15d of the pusher body 15a, which allows the urging face 15d to become upright when the pusher body 15a tilts due to pressure from the article S in contact therewith, so as to urge the articles S forward in this state.

[0033] The auxiliary roller 15c (see FIG. 8) is mounted on the lower side face of the pusher body 15a such that it is rotatable about its vertical axis and rolls on the lower side face of the body plate 17a of the guide rail 17. The auxiliary roller 15c enables the pusher body 15a to maintain perpendicularity of the urging face 15d thereof with respect to a plane in which the guide rail 17 extends, whereby the frictional resistance to the movement of the pusher 15 along the guide rail 17 can be further decreased. The pusher 15 is always urged forward by a drive mechanism (urging means) 20, referred to hereinafter, and held in engagement with the guide rail 17 when it moves to its extreme forward position.

[0034] Next, the operation of the article storage device constructed as above will be described. When an article rack 10 is required to be replenished with articles S, the article rack 10 is drawn forward out of the machine body 3 as shown in FIG. 4, and a large number of articles S are placed one behind another in each of the article passages 11, with the pusher 15 held in engagement with the machine body 3. When the article rack 10 is pushed back into the machine body 3 after the replenishment, each of the pusher bodies 15a is urged backward by a rearmost one of the articles S received in a corresponding one of the article passage 11, whereby the pusher 15 is moved along the guide rail 17 together with the article rack 10 from its extreme forward position shown by solid lines in FIG. 9 to its extreme backward position shown by phantom lines in the same figure. As a result, the numerous articles S are held in a state sandwiched between the rack opening/closing plate 12 held in its closed position by the stopper plate 9 and the pusher body 15a of the pusher 15 urged forward by the drive mechanism 20, and thus made ready for vending.

[0035] On the other hand, during the vending operation, the stopper plate drive mechanism 13 drives the drive shaft 9a for rotation through a predetermined angle, whereby the stopper plate 9 slides in one direction to release one of the rack opening/closing plates 12 on an opposite side to the direction of the movement of the stopper plate 9. The released rack opening/closing plate 12 is pivotally moved to its open position by the urging force of the spring, whereby the dispensing opening 11a of the article passage 11 is opened for dispensing an article S from the article passage 11. At this time point, an article S immediately behind the dispensed article S is blocked by the blocking plate 14 from being dispensed from the article passage 11.

[0036] As described above, after the replenishment of articles S, the pusher 15 moves backward along the

guide rail 17 in a state of its pusher body 15a being pushed by the articles S, while during a vending operation, it moves forward along the guide rail 17 in a state of its pusher body 15a pushing the articles S. In the present embodiment, the front and rear rollers 15b, 15b attached to the pusher body 15a roll on the guide rail 17, and further, the rollers 15b are each equipped with the bearing for preventing direct torque transmission between the roller 15b and its rotational shaft, so that moment on the pusher body 15a produced by the urging force acting between the articles S and the pusher body 15a is absorbed by the rollers 15b, 15b, whereby frictional resistance to the movement of the pusher 15 can be far more reduced compared with the conventional construction of the article storage device.

[0037] Further, the above characteristic features and advantages of the present invention that the auxiliary roller 15c rolling on the side face of the body plate 17a of the guide rail 17 enables the pusher body 15a to maintain perpendicularity of the urging face 15d thereof with respect to a plane in which the guide rail 17 extends, that the guide rail 17 can be produced to close dimensional tolerances by using an extrusion molded article, and that the guide rail 17 is improved in smoothness of guide surfaces thereof by surface treatment by using alumite all contribute to further decreasing the frictional resistance to the movement of the pusher 15 to near zero. As a result, the urging force of the drive mechanism required for moving the pusher 15 forward can also be reduced, which enhances ease of handling of the article rack 11 when replenishment of vendible articles is carried out.

[0038] Moreover, since the rollers 15b, 15b are mounted on the guide rail 17 such that they are rotatable about their respective horizontal axes with the U-shaped grooves thereof being engaged with the upper and lower guide protrusions 17c, 17c, it is possible to construct the guide rail 17 such that it has a smaller width (dimension in a side-to-side direction of the vending machine), compared with a case in which the whole of each roller 15 is received in the guide rail 17. The guide rail 17 also serves as a partition wall for separating the upper spaces of the article passage 11, 11 from each other, so that the guide rail 17 having a reduced width allows larger space to be used for storing articles S.

[0039] Next, the above-mentioned drive mechanism 20 for urging a corresponding pusher 15 will be described in detail with reference to FIGS. 8 to 12. The drive mechanism 20 is provided for each pusher 15 (see FIG. 11 etc.) and received between an upper case plate 21 and a lower case plate 22 which protrude from the respective top side and bottom side surfaces of a corresponding one of the shelves 16 (see FIGS. 8 and 9). These case plates 21, 22 are each constructed to have a small protrusion dimension, i.e. form a container having a small thickness or height. The drive mechanism 20 is connected to the pusher 15 by a wire 19. The wire 19

is passed over a small pulley 18 arranged at a front end of the bottom side surface of the shelf 16 and then connected to a hook 15f formed on the top of the pusher 15.

[0040] As shown in FIG. 10, the drive mechanism 20 includes a reduction mechanism 23 comprised of a pulley gear 24, an intermediate gear 25, and a drum gear 26, which mesh with one another. The gears 24, 25 and 26 are rotatably supported on respective axes G1, G2 and G3 extending through the upper and lower case plates 21, 22. The pulley gear 24 is comprised of a pulley 24a over which the wire 19 is passed and a gear 24b formed integrally on the upper side of the pulley 24a. The intermediate gear 25 is comprised of a large gear 25a in mesh with the gear 24b and a small gear 25b integrally formed with the large gear 25a. The small gear 25b of the intermediate gear 25 meshes with a gear 26a of the drum gear 26. A cylindrical drum 26b is formed integrally on the lower side of the gear 26b.

[0041] On the underside of the drum gear 26, there are formed two projections 26c, 26c, which are each engaged with one end portion of a corresponding one of two helical tension springs 30, 30. The helical tension springs 30, 30, which have an identical spring constant, are arranged in parallel with each other, and the other end portions thereof are connected respectively to hooks 16a, 16a (only one of which is shown in FIG. 9) projecting downward from the underside of the shelf 16.

[0042] In the drive mechanism 20 constructed as above, when the article rack 10 is pushed back into the machine body 3 after being replenished with articles S, to thereby move the pusher 15 to its extreme backward position along the guide rail 17, the wire 19 is pulled, whereby the pulley gear 24 rotates in a counterclockwise direction, as viewed in FIG. 10B, to cause the drum gear 26 to rotate in the same direction via the intermediate gear 25. As the drum gear 26 rotates, the helical tension springs 30 are each extended through being wound around the drum 26b.

[0043] As described above, the drive mechanism 20 makes it possible to secure a longer range of travel of the pusher 15 with respect to a limited length of expansion of each of the helical tension springs 30 through the combination of the helical tension springs 30 and the reduction mechanism 23. Further, the urging force of the helical tension springs 30, i.e. an urging load on the pusher 15 is maximized when the pusher 15 is at its extreme backward position, and minimized when the pusher 15 is at its extreme forward position. Still further, the two helical tension springs 30, 30 connected to the gear 26a of the drum gear 26 in a manner point-symmetrical and parallel with each other transmit torque to the drum gear 26 in a dynamically well-balanced fashion, thereby enabling the pusher 15 to be urged smoothly. Reference numeral 27 appearing in FIGS. 10A to 12 indicates a sold-out switch for detecting a sold-out state of articles S in a corresponding one of the article passages 11. This switch 27 is turned on by a projection 26d formed on the drum gear 26 when the

pusher 15 moves to its extreme forward position.

[0044] The present invention is not limited to the above embodiment, but it can be practiced in various forms. For instance, although in the above embodiment, each article rack is formed with a pair of right and left article passages, and two pushers each provided for one of the article passages are guided along an identical guide rail, this is not limitative, but the invention may be applied to an article rack having a single article passage formed therein.

[0045] It is further understood by those skilled in the art that the foregoing is a preferred embodiment of the invention, and that various changes and modifications may be made without departing from the spirit and scope thereof.

Claims

1. An article storage device for a vending machine, including an article rack provided within a body of said vending machine in a manner such that said article rack can be moved in a front-rear direction and drawn forward out of said body of said vending machine, said article rack having an article passage formed therein for receiving a large number of articles one behind another, a rack opening/closing member provided at a front end of said article rack, for opening a dispensing opening of said article passage during a vending operation, and closing said dispensing opening except during said vending operation, a pusher inserted in said article passage, for pushing forward said articles received in said article passage, a guide member arranged above said article rack in a manner such that said guide member extends in said front-rear direction, for guiding said pusher in said front-rear direction, and urging means for urging said pusher forward,

the article storage device being characterized in that:

said guide member comprises a body plate extending vertically, and a guide portion integrally formed with said body plate, said guide portion having a pair of guide protrusions laterally spaced from said body plate and being vertically opposed to each other, and said pusher comprises a pusher body inserted into said article passage, and a pair of front and rear rollers each formed with a U-shaped groove and attached to an upper side face of said pusher body in a manner rotatable about respective horizontal axes, said pusher being mounted between said vertically opposed guide protrusions of said guide portion of said guide member, with said U-shaped groove of each of said rollers being fitted on said vertically opposed guide protrusions.

2. An article storage device according to claim 1,
wherein said each of said rollers is equipped with a
bearing.
3. An article storage device according to claim 1 or 2, 5
wherein said pusher further comprises an auxiliary
roller mounted on said pusher body at a location
below said rollers, for rotation about a vertical axis
of said auxiliary roller to roll on a side face of said
body plate of said guide member. 10
4. An article storage device according to any one of
claims 1, 2 or 3, wherein said guide member is
made of an extrusion molded article of aluminum. 15
5. An article storage device according to claims 4,
wherein said guide member is subjected to surface
treatment by using alumite.

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FIG. 1

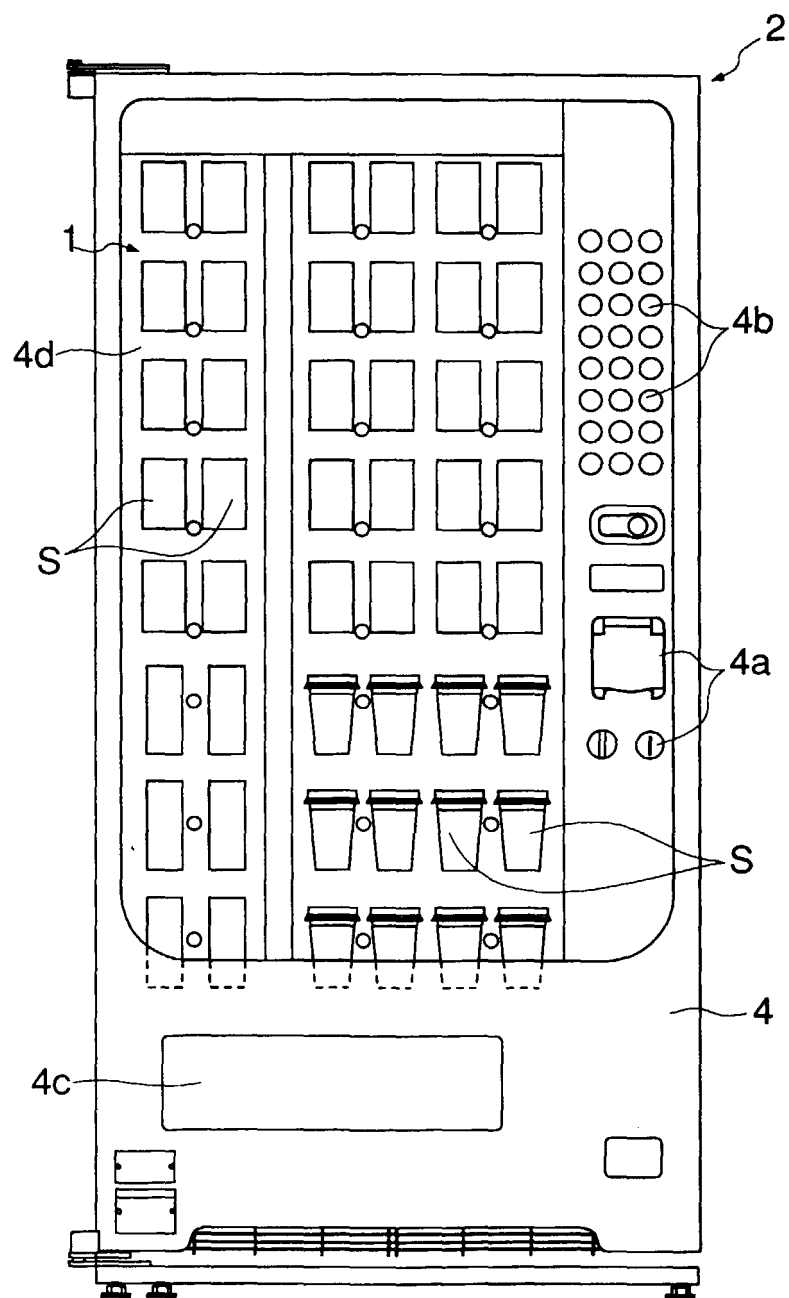


FIG. 2

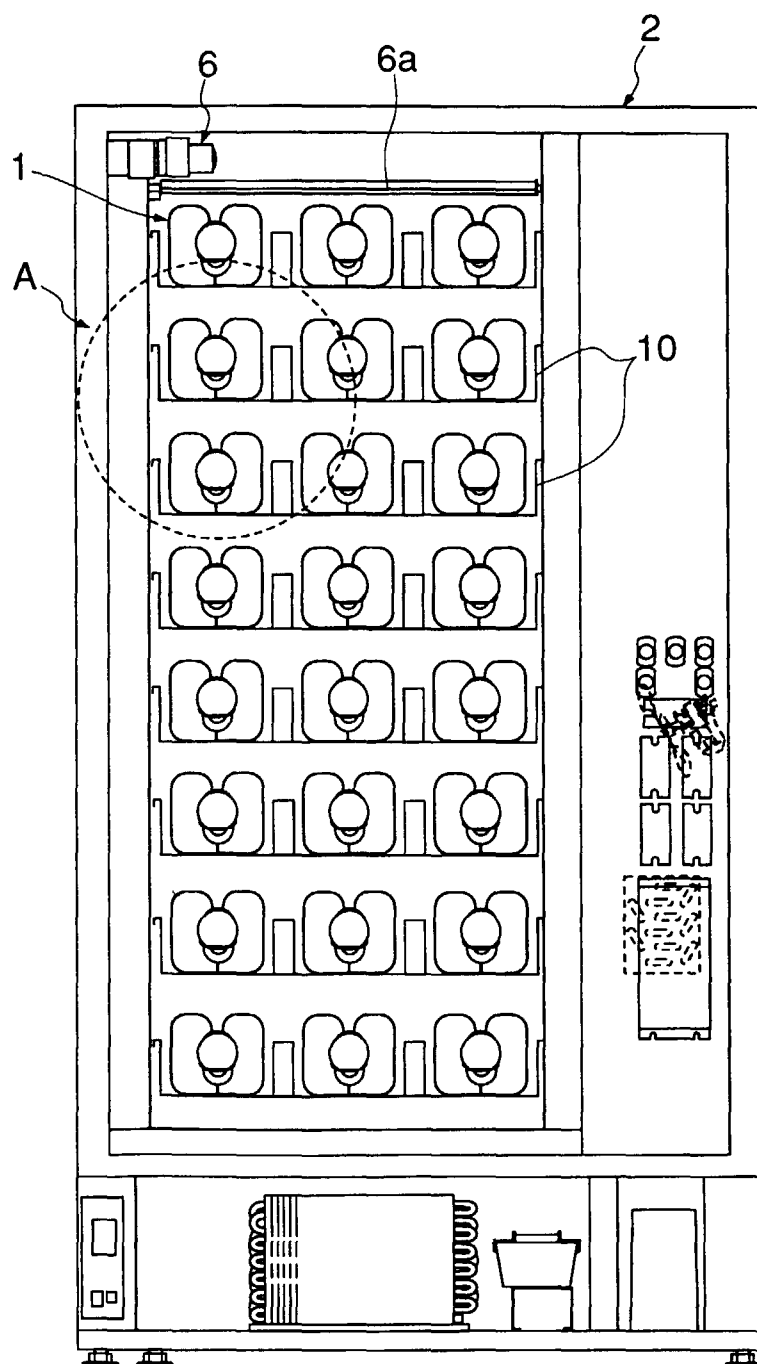
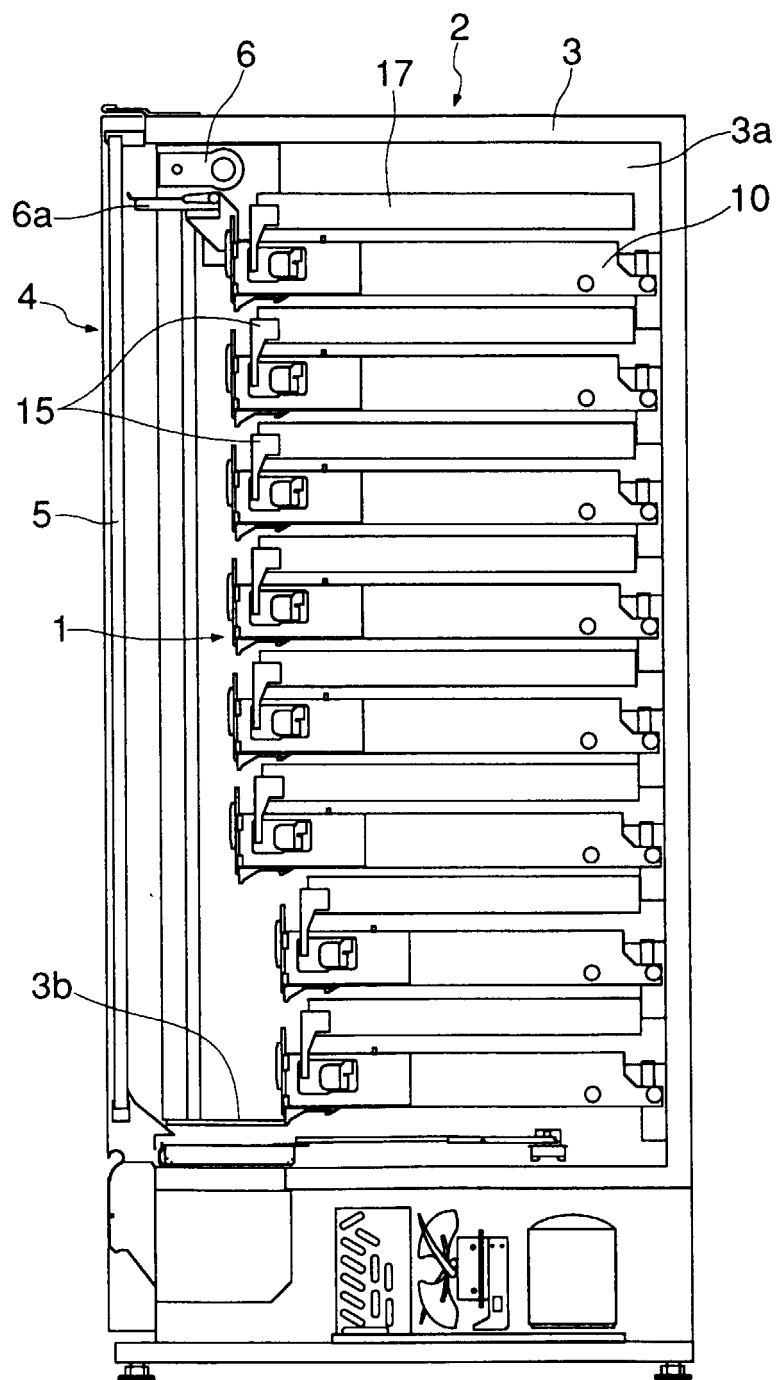


FIG. 3



F I G . 4

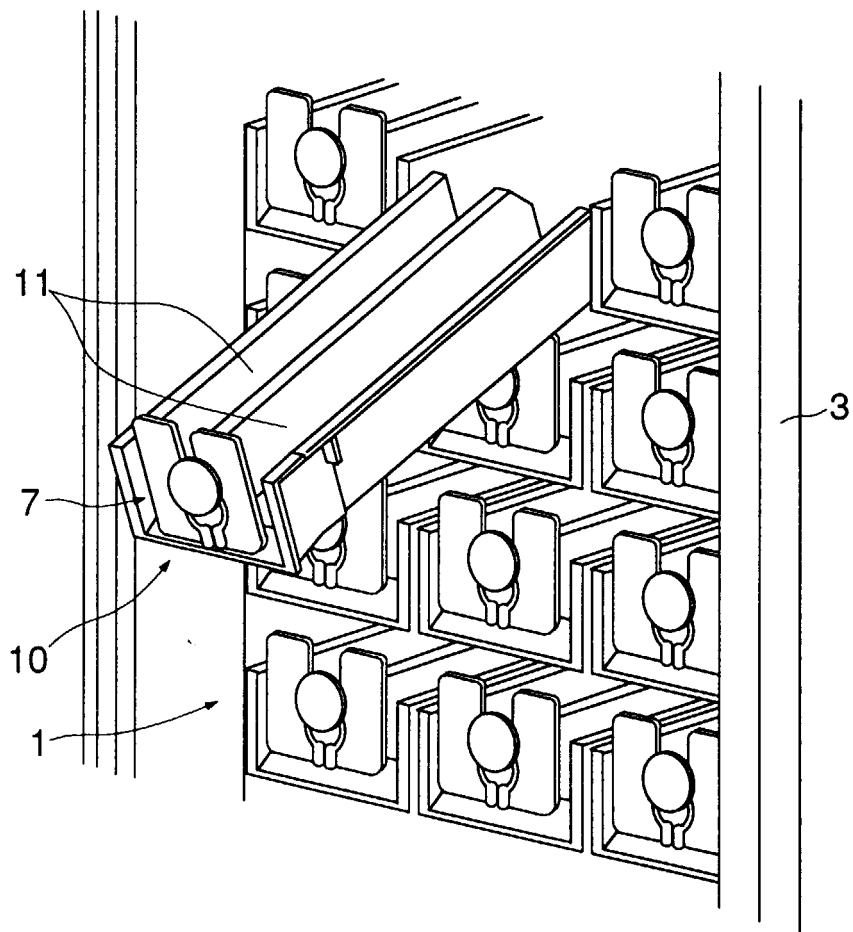
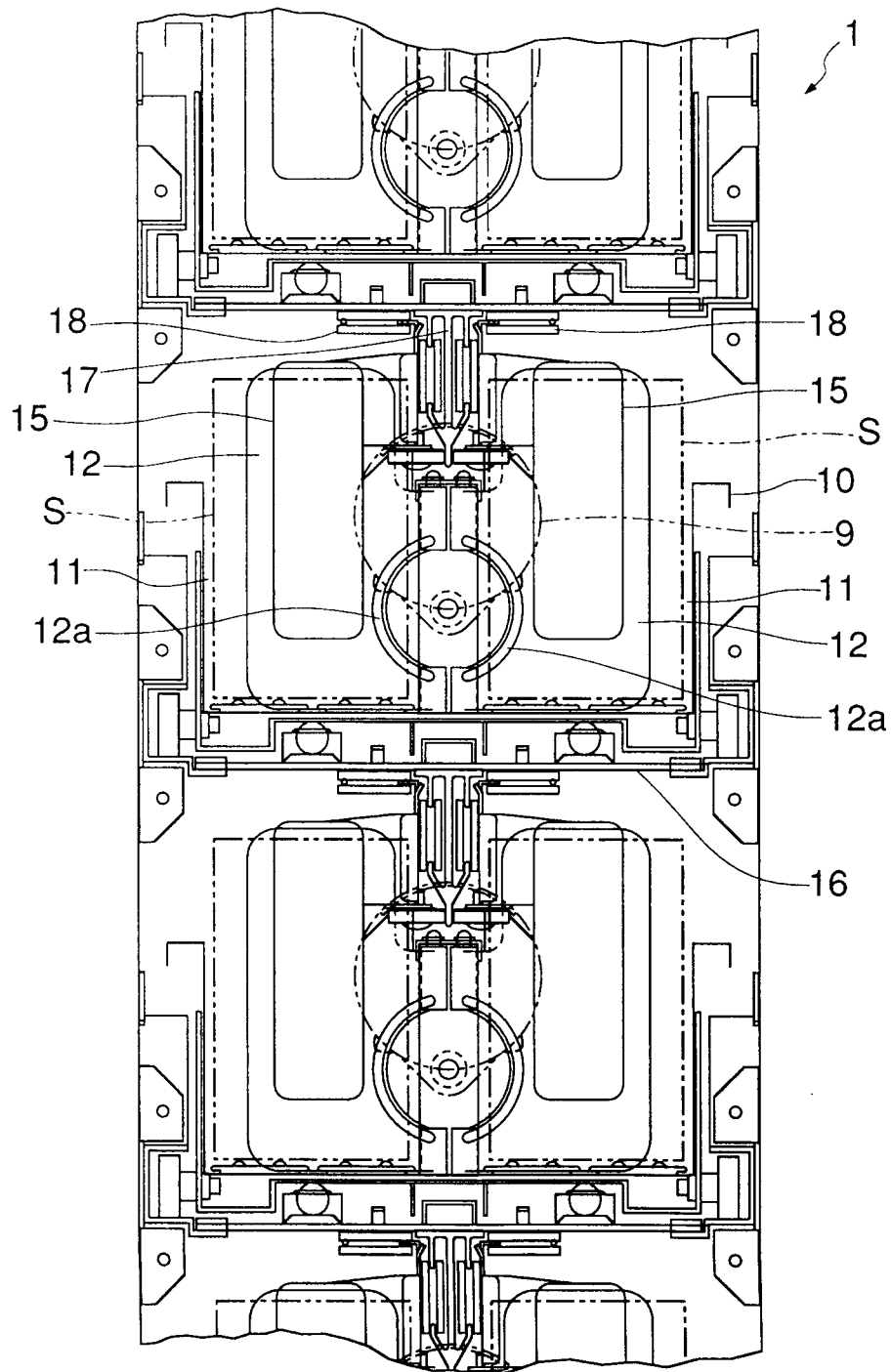


FIG. 5



F I G. 6

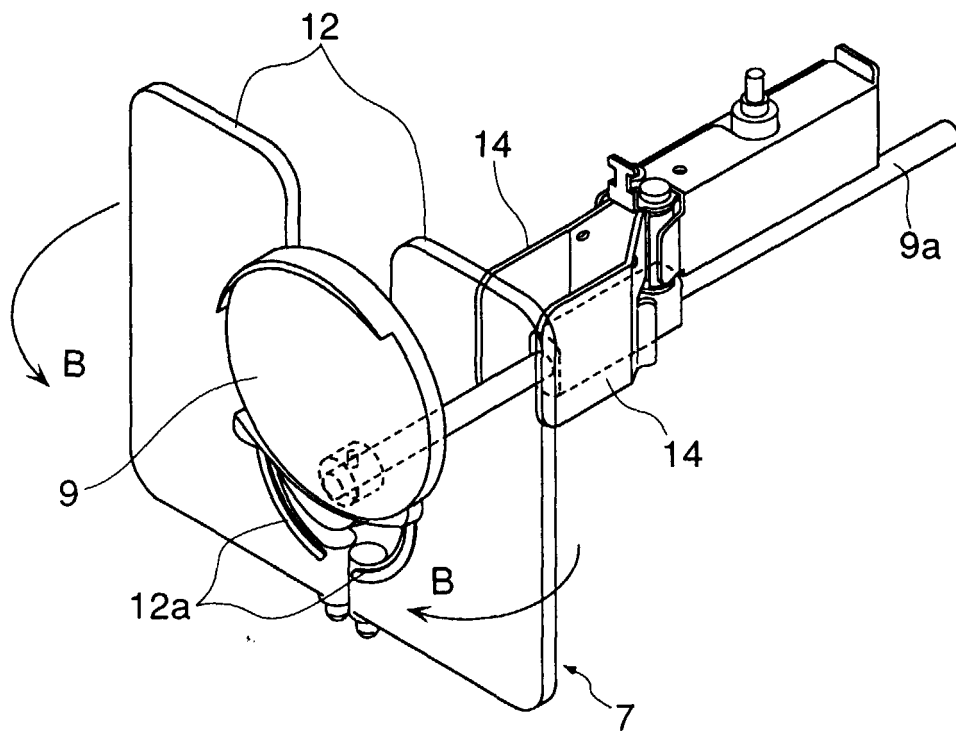


FIG. 7

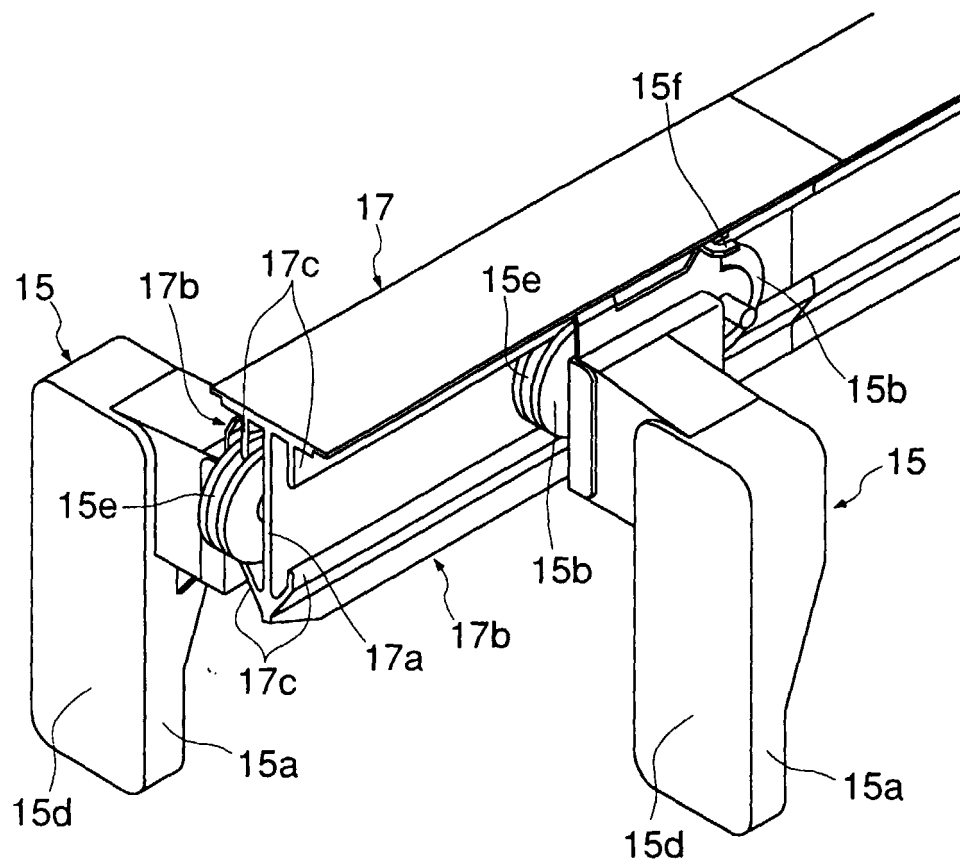


FIG. 8

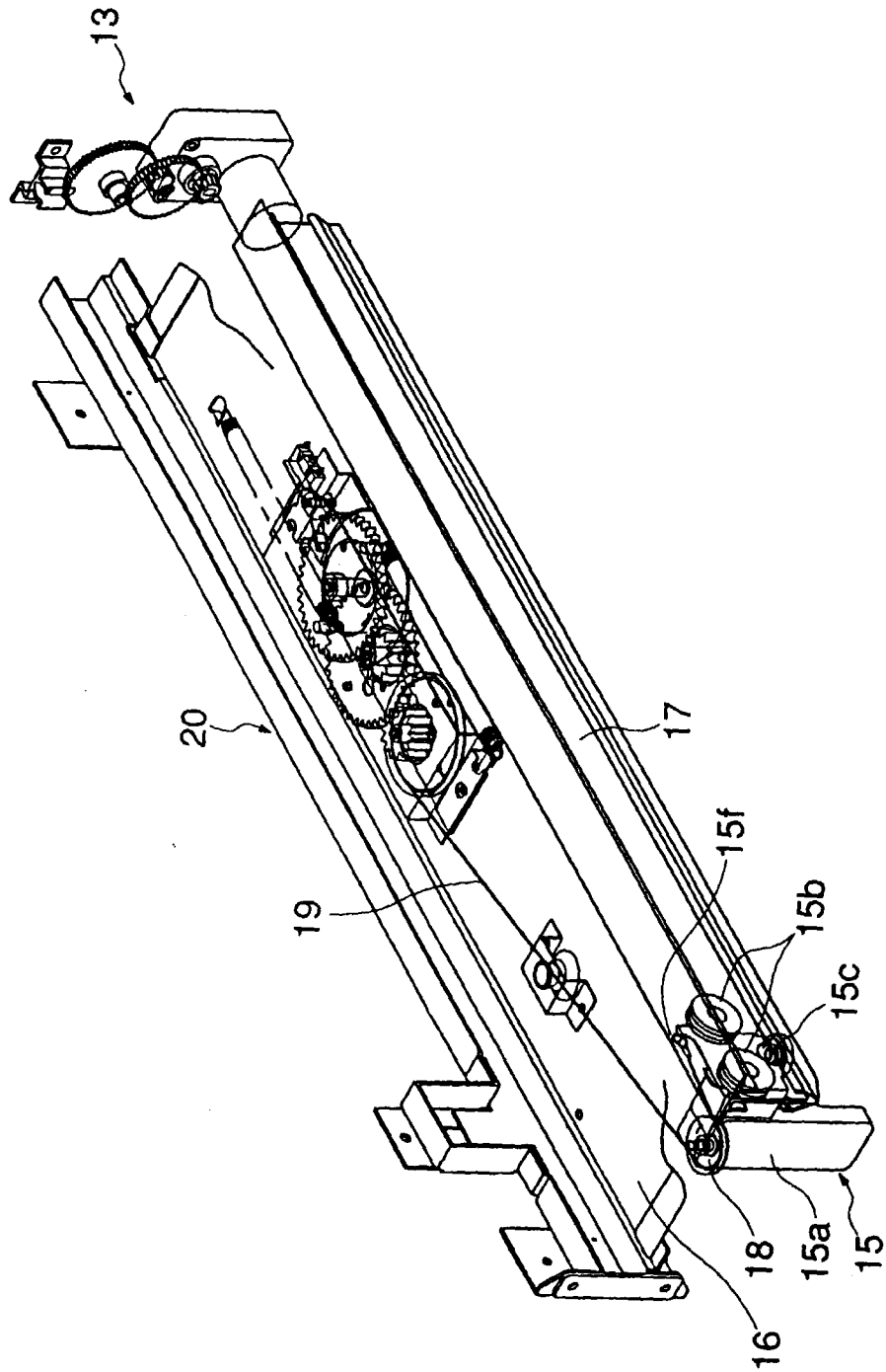


FIG. 9

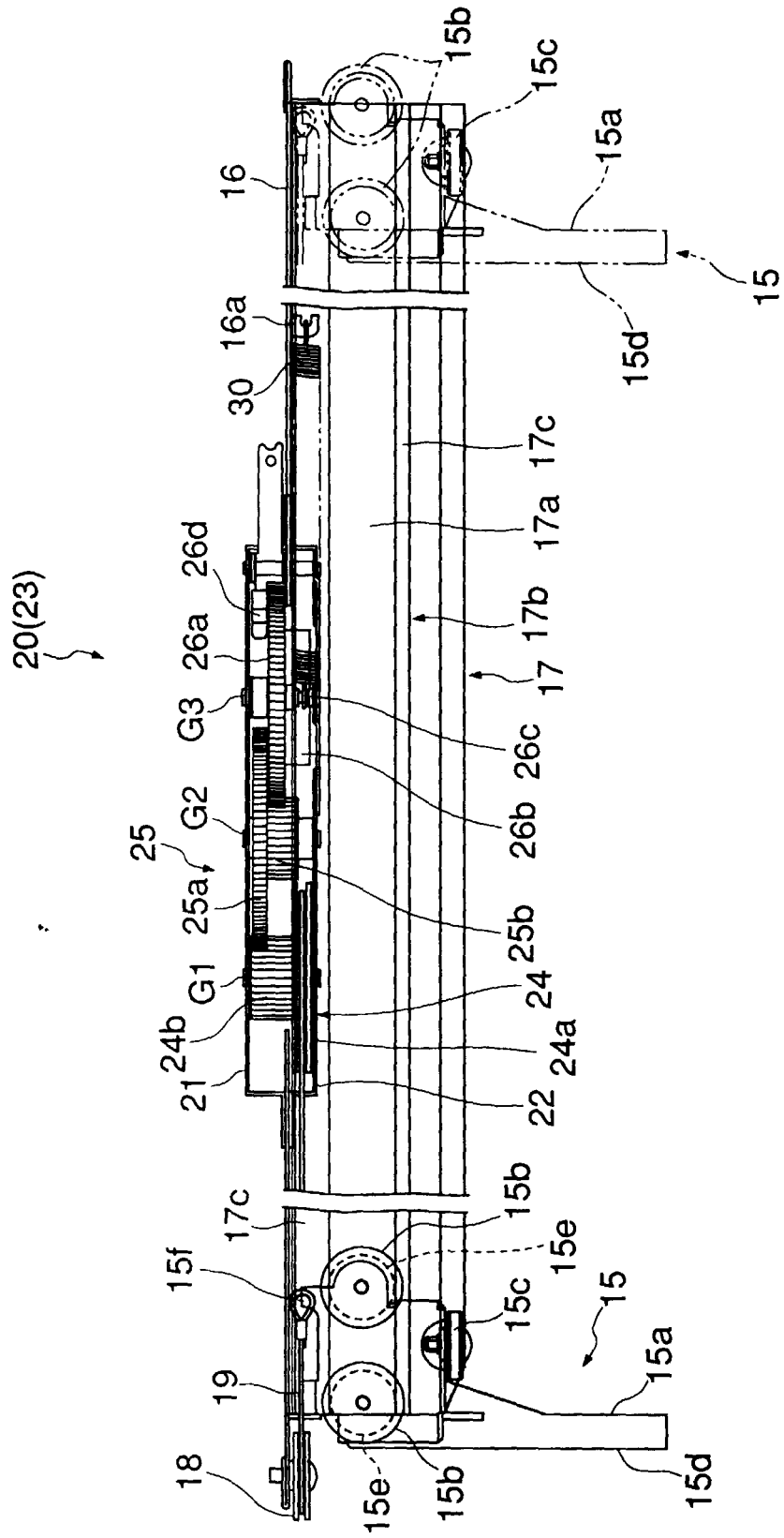


FIG. 10 A

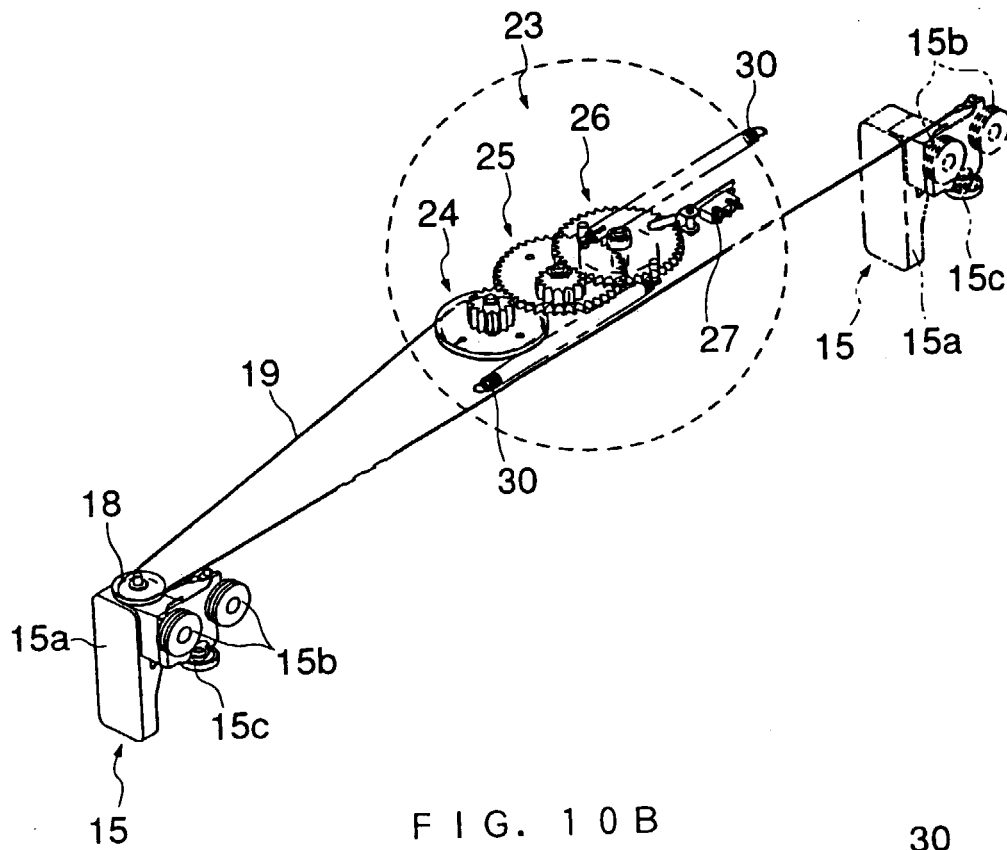


FIG. 10 B

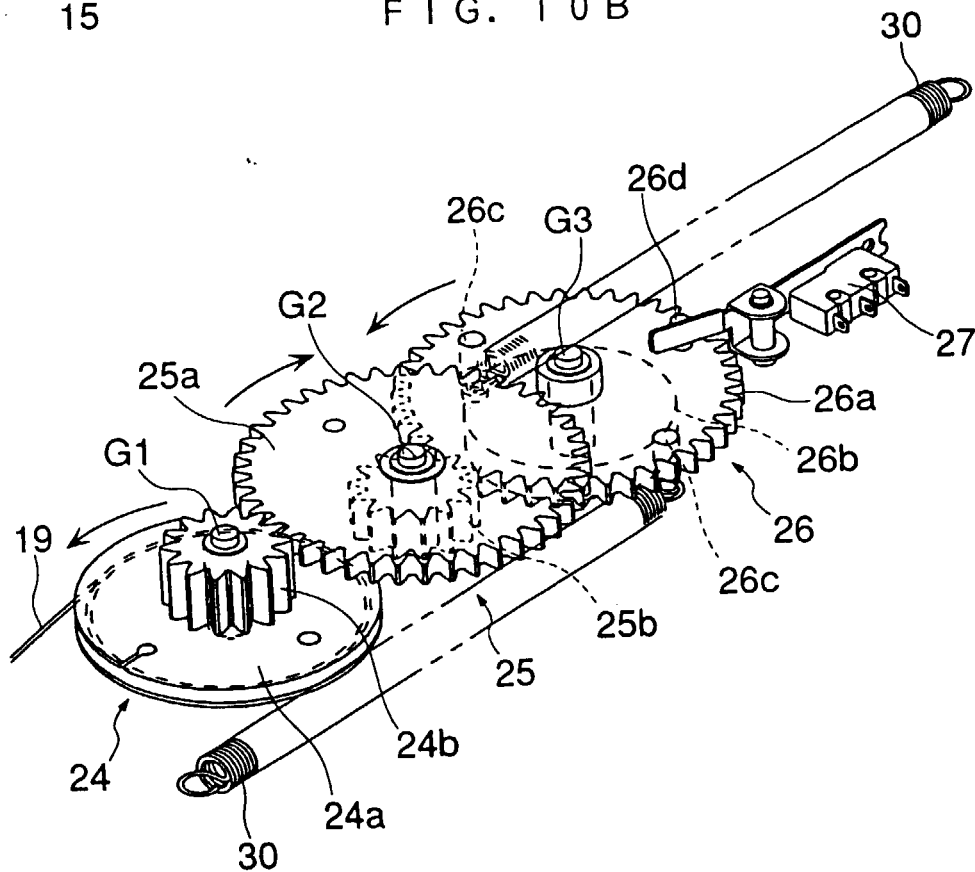
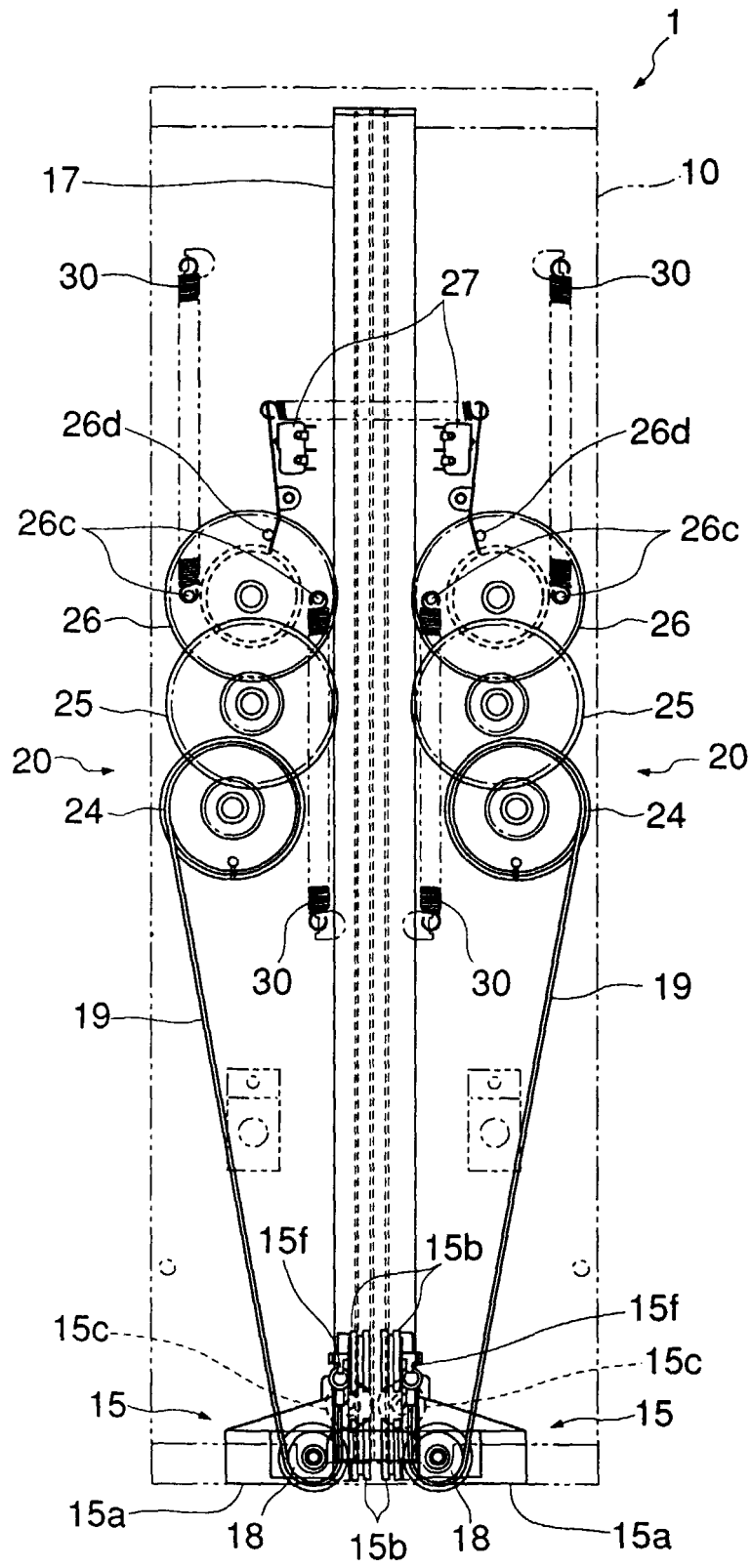


FIG. 11



F I G. 12

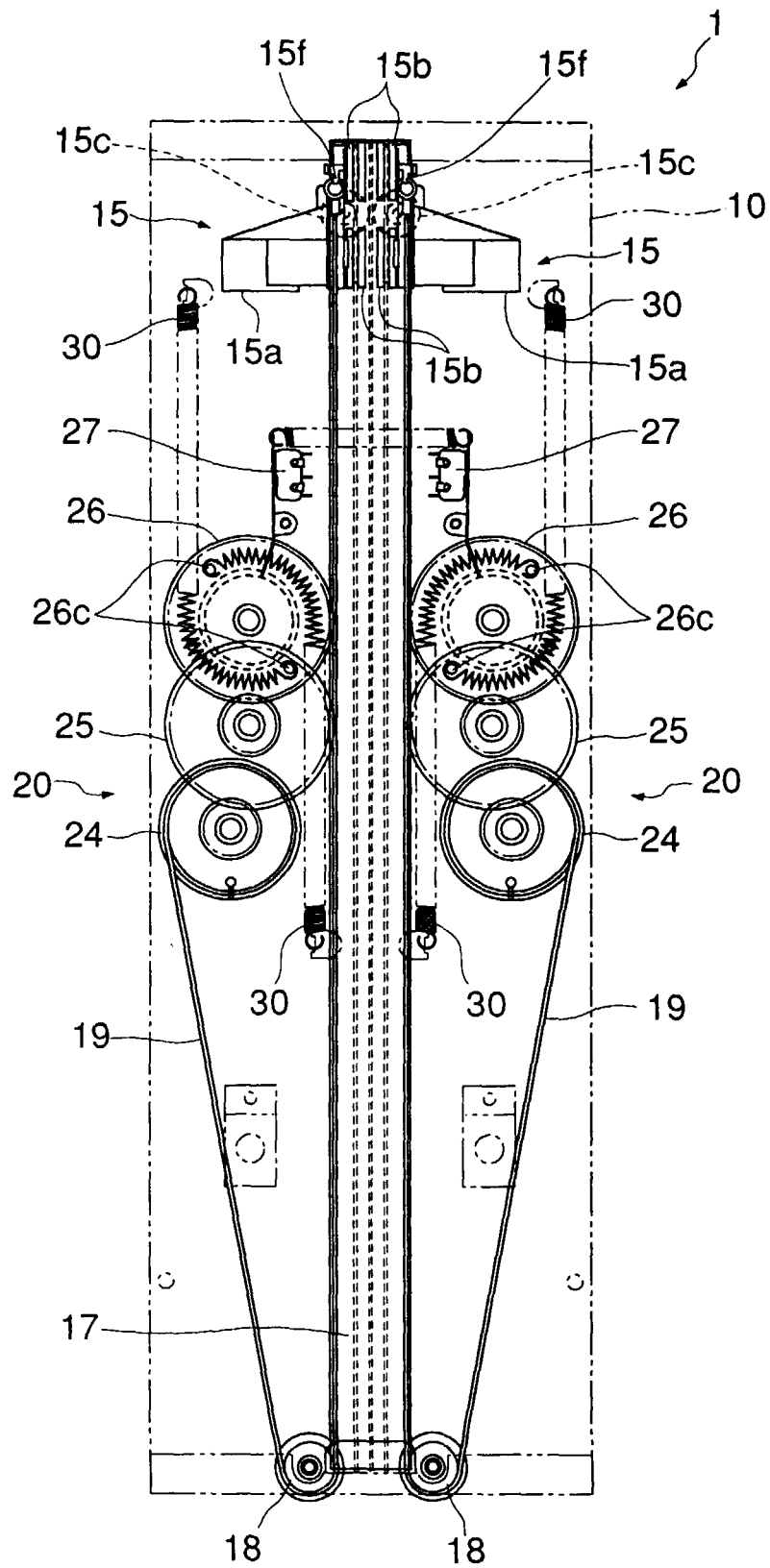


FIG. 13
PRIOR ART

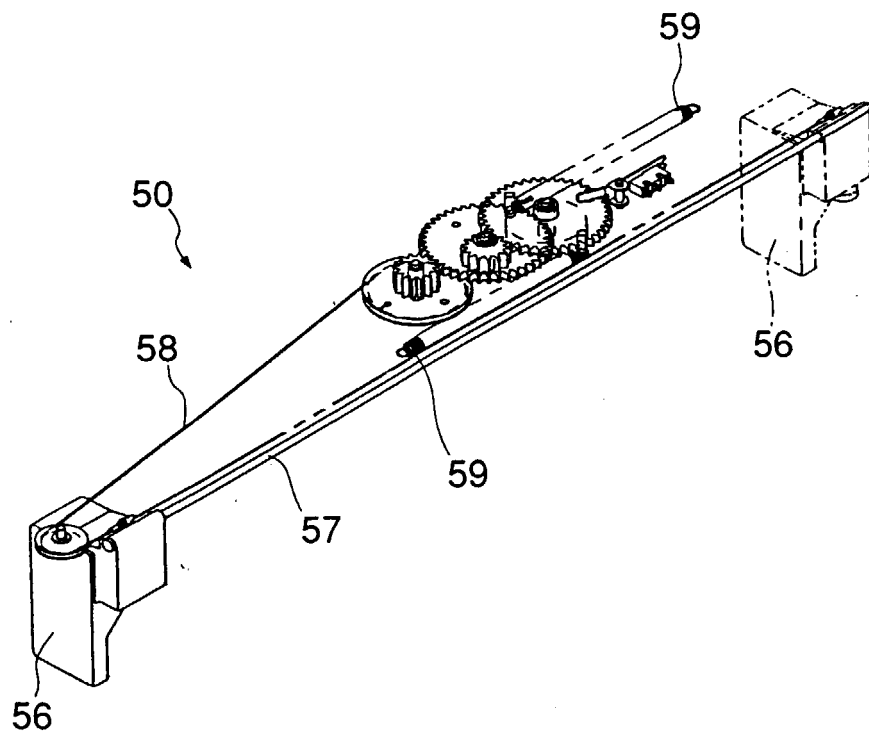
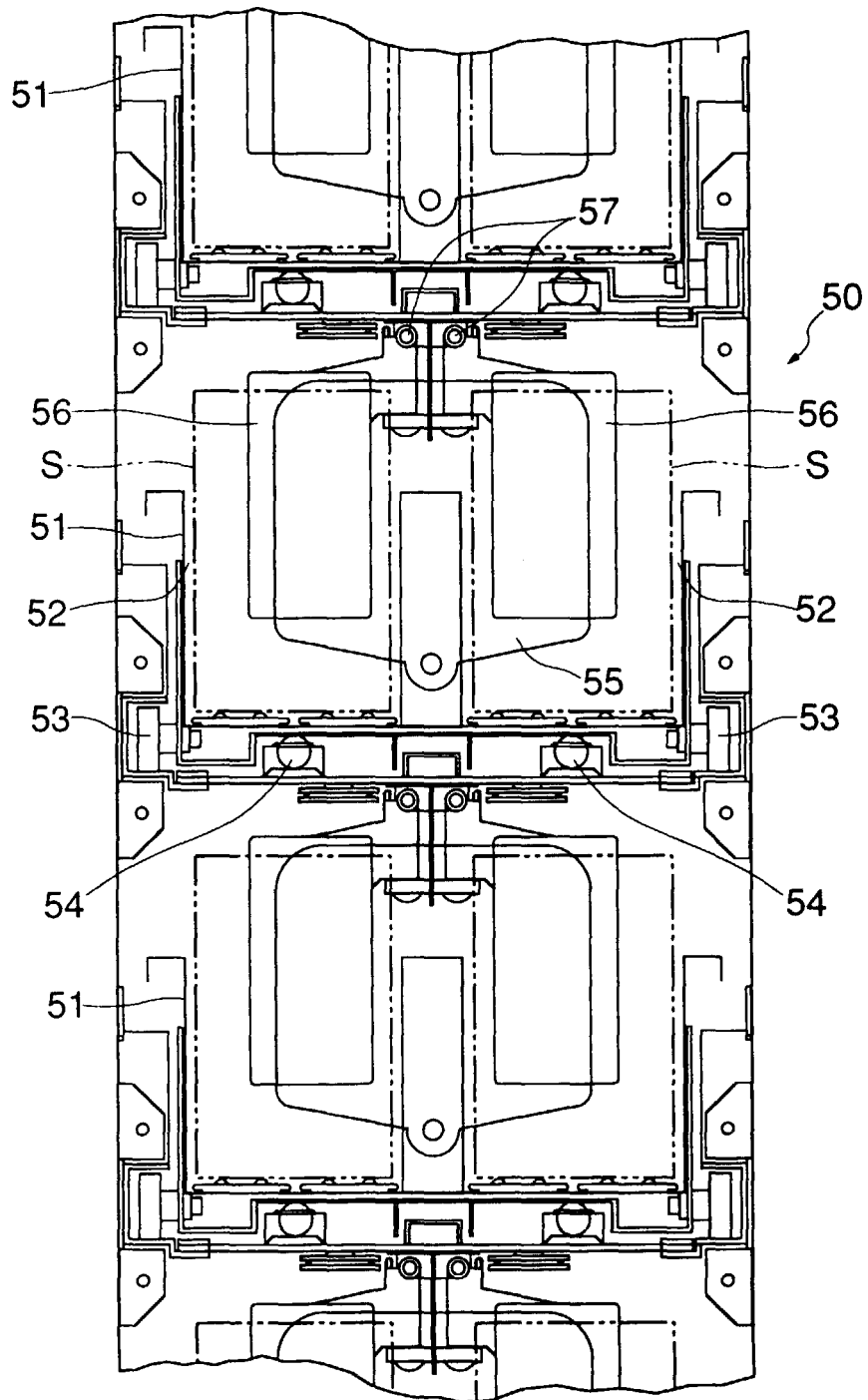


FIG. 14
PRIOR ART





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Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	US 4 200 201 A (COLLINS ET AL.) 29 April 1980	1	G07F11/38 G07F11/42
A	* column 3, line 66 - column 4, line 63 * * column 6, line 7 - line 62; figures 1-4,7,8 *	2-5	
Y	PATENT ABSTRACTS OF JAPAN vol. 98, no. 14, 31 December 1998 & JP 10 255140 A (MATSUSHITA REFRIG CO LTD), 25 September 1998 * abstract *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 98, no. 14, 31 December 1998 & JP 10 255154 A (SANYO ELECTRIC CO LTD), 25 September 1998 * abstract *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 98, no. 12, 31 October 1998 & JP 10 188107 A (SANYO ELECTRIC CO LTD), 21 July 1998 * abstract *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G07F
A	US 3 282 466 A (MERESZ ET AL.) 1 November 1966 * column 3, line 65 - column 6, line 37; figure 8 *	1	
A	US 2 893 596 A (GABRIELSEN) 7 July 1959 * column 3, line 57 - column 5, line 44; figures 1,2,5 *	1	
A	WO 90 12377 A (ADVANCED VENDING SERVICES LIMITED) 18 October 1990 * page 2, line 29 - page 5, line 29; figures 1-3 *	1	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 March 1999	Examiner Rivero, C
CATEGORY OF CITED DOCUMENTS X particularly relevant if taken alone Y particularly relevant if combined with another document of the same category A technological background O non-written disclosure P intermediate document T theory or principle underlying the invention E earlier patent document, but published on, or after the filing date D document cited in the application L document cited for other reasons & member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 12 2713

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 98, no. 11, 30 September 1998 & JP 10 154267 A (MATSUSHITA REFRIG CO LTD), 9 June 1998 * abstract * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		18 March 1999	Rivero, C
CATEGORY OF CITED DOCUMENTS X particularly relevant if taken alone Y particularly relevant if combined with another document of the same category A technological background O non-written disclosure P intermediate document T theory or principle underlying the invention E earlier patent document, but published on, or after the filing date D : document cited in the application L document cited for other reasons & member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P4/C01)

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ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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18-03-1999

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