United States Patent

[11] 3,608,777

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Owen J. Schwertfeger, Chicago; Roy A. Johnson, Chicago, all of Ill.

[21] Appl. No. **759,478**
[22] Filed **Sept. 12, 1968**
[45] Patented **Sept. 28, 1971**
[73] Assignee Walter E. Heller & Company, Chicago, Ill.

[54] ARTICLE-VENDING APPARATUS UTILIZING DISPLACEABLE ARTICLE-CONTAINING TRANSPORT MEMBERS

18 Claims, 49 Drawing Figs.

[52] **U.S. Cl.** **221/129**
[51] **Int. Cl.** **B65g 59/00**
[50] **Field of Search** 221/129, 122, 125, 272–274, 197, 198, 186, 187

[56] **References Cited**

UNITED STATES PATENTS

2,893,596	7/1959	Gabrielsen	221/129
3,002,602	10/1961	Giepen	221/122 X
3,237,745	3/1966	Gerhart et al.	221/129 X

Primary Examiner—Stanley H. Tollberg
Attorneys—Ronald L. Engel, Daniel W. Vittum, Jr. and Gomer W. Walters

ABSTRACT: Article vending is achieved by utilizing article-containing transport members that are displaced for vending of an article thereon. The movable trays are horizontally disposed in drawers, with a plurality of vertically separated drawers positioned in a cabinet. Selection of an article located on a transport member results in that transport member being displaced to position the rearmost article on the transport member in a vend area, from whence it is conveyed to a dispensing area by a vertically movable extracting member.

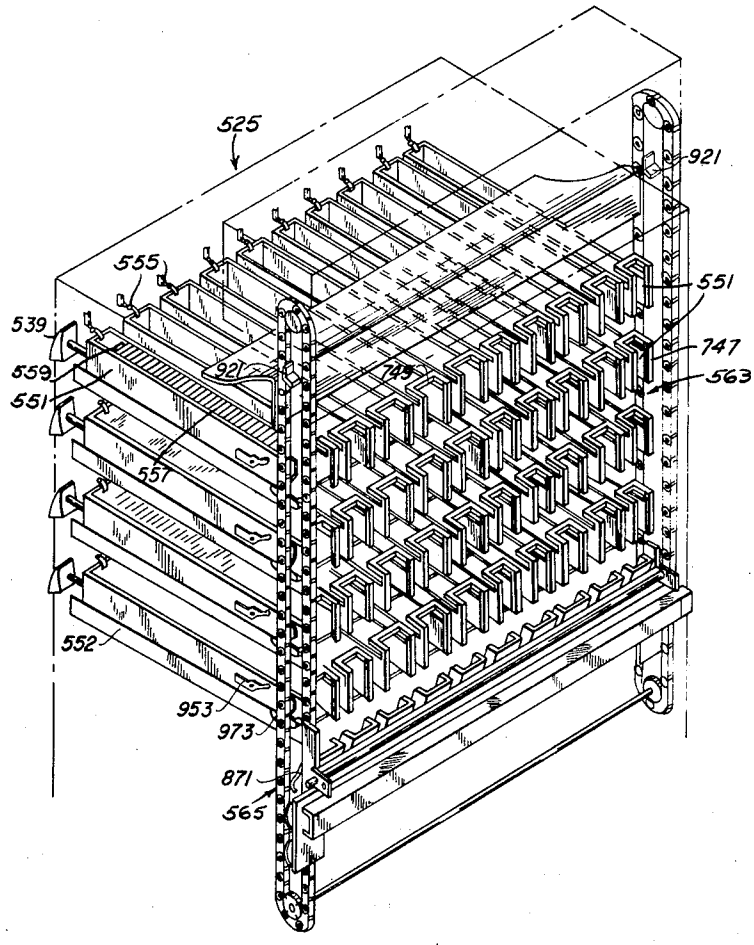
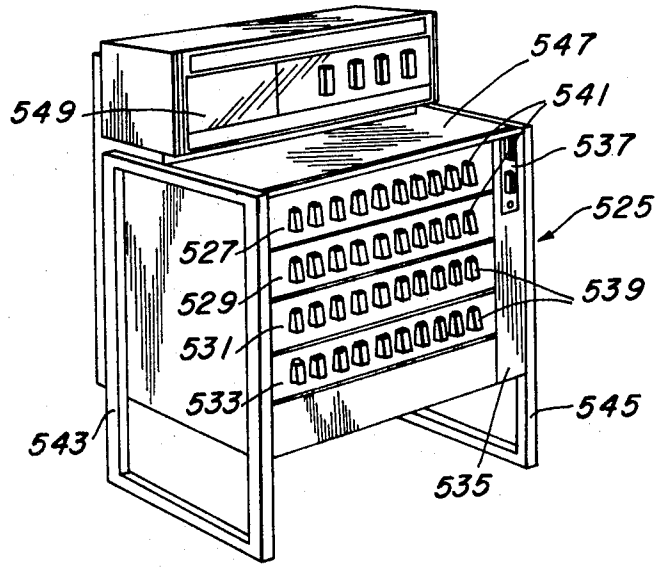


FIG - 1



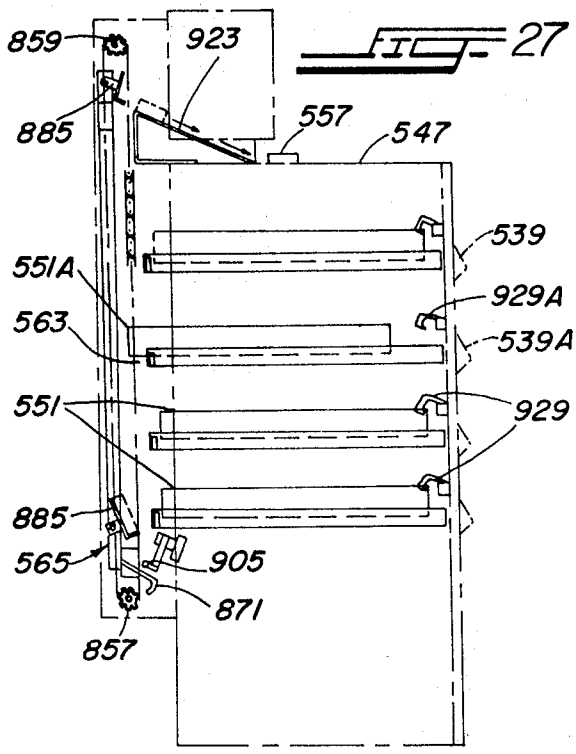
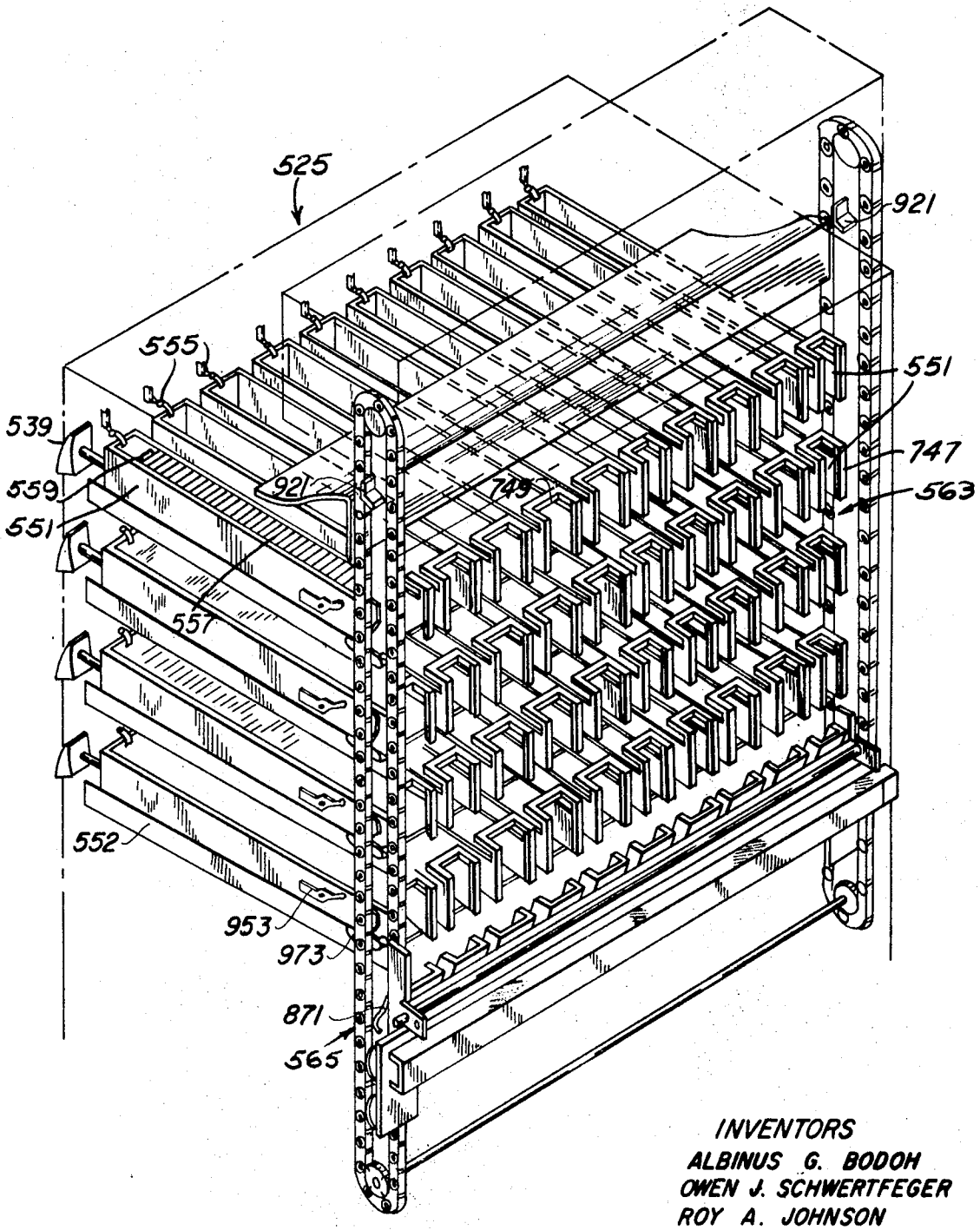


FIG - 27

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FIG-2



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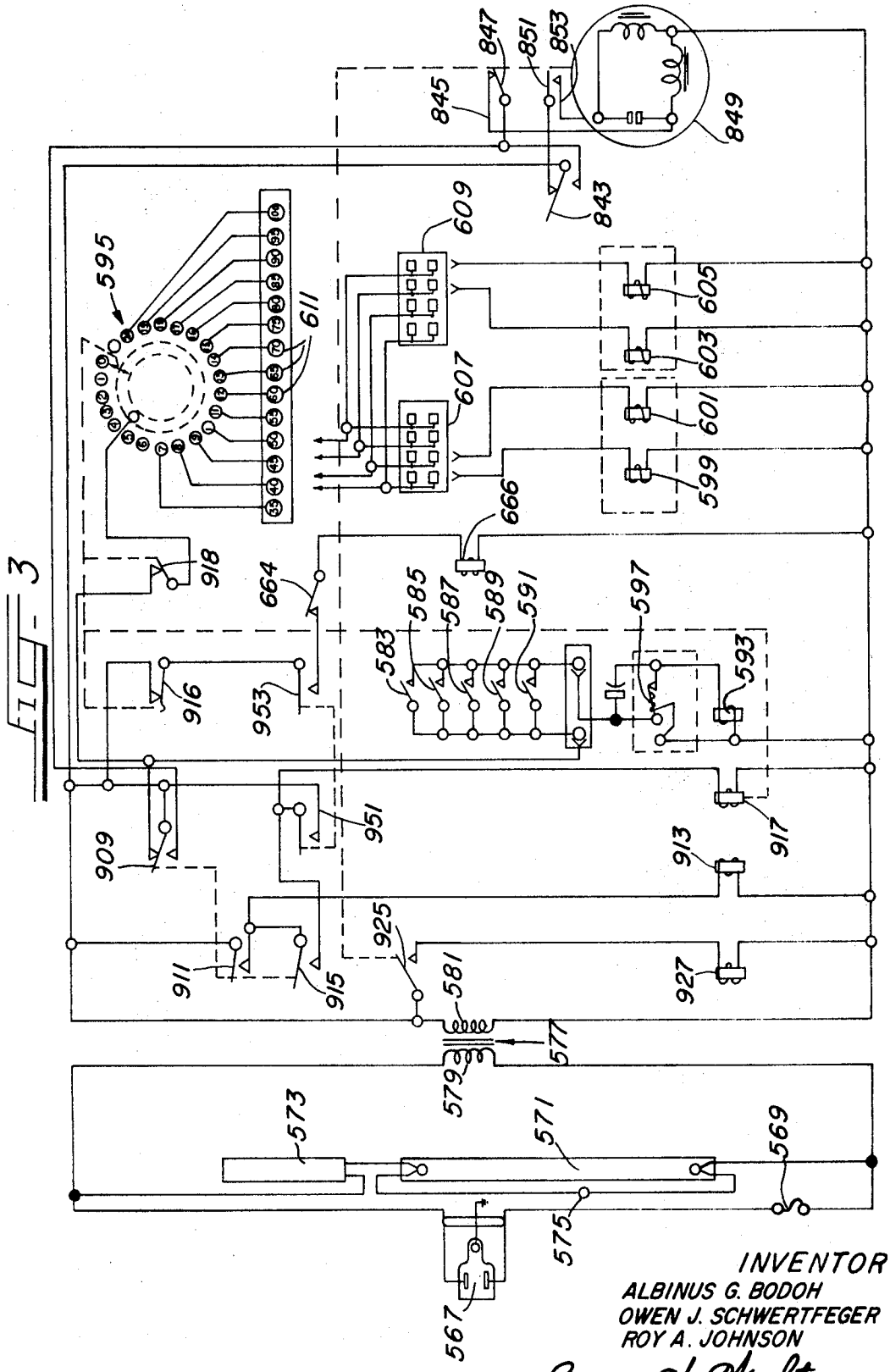


FIG. 3

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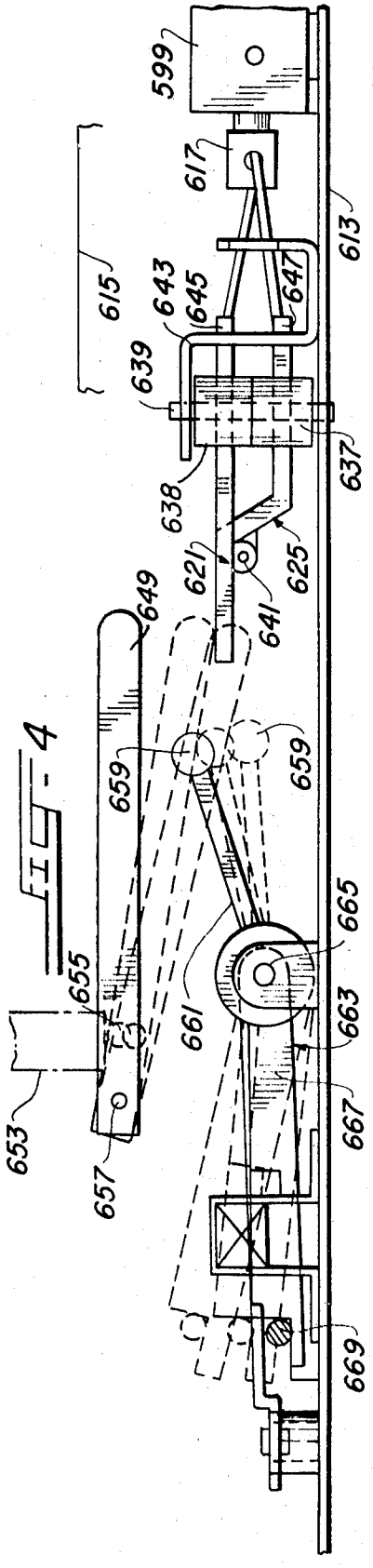


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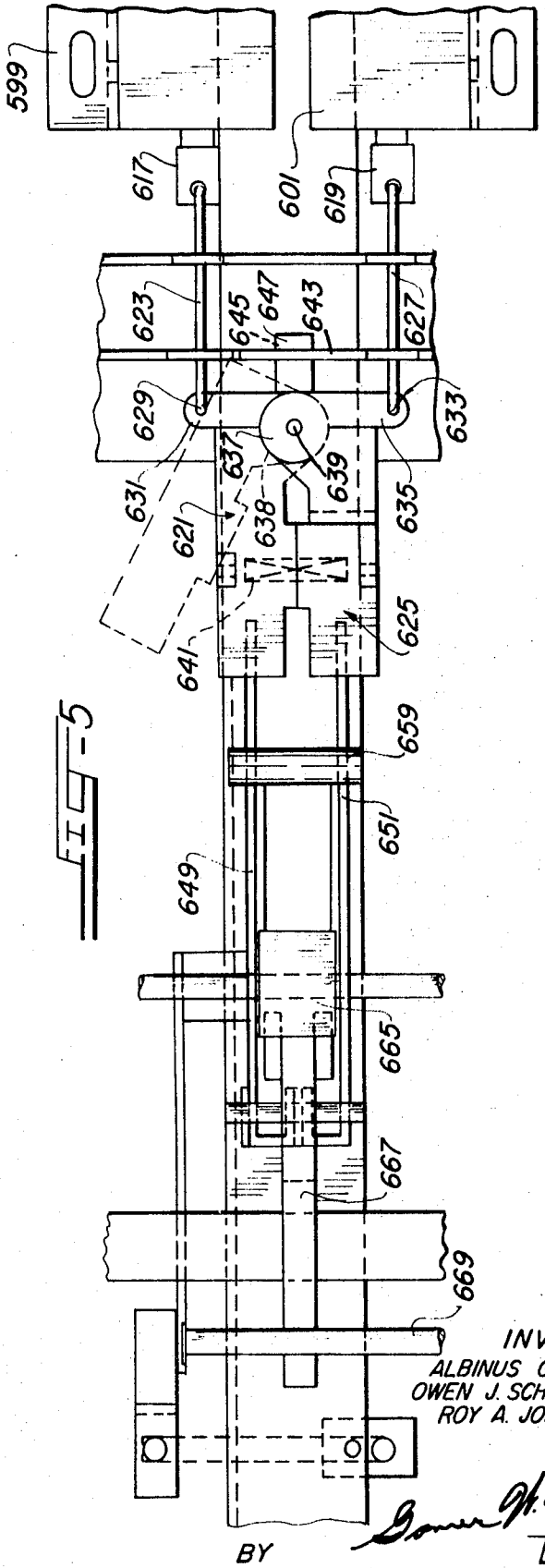


FIG-5

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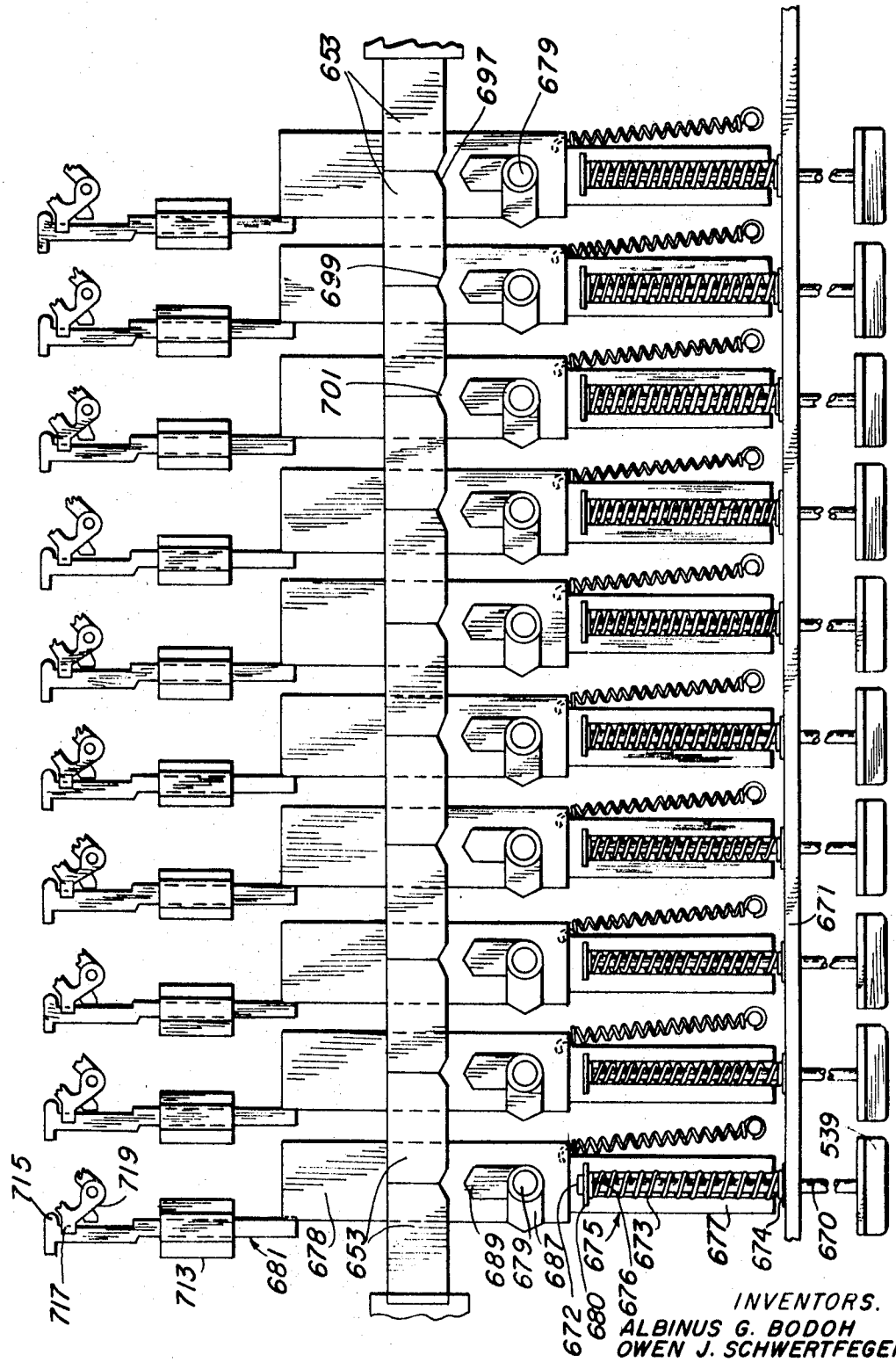


FIG. 6

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BY Gomer G. Walters ATT'Y.

FIG 9

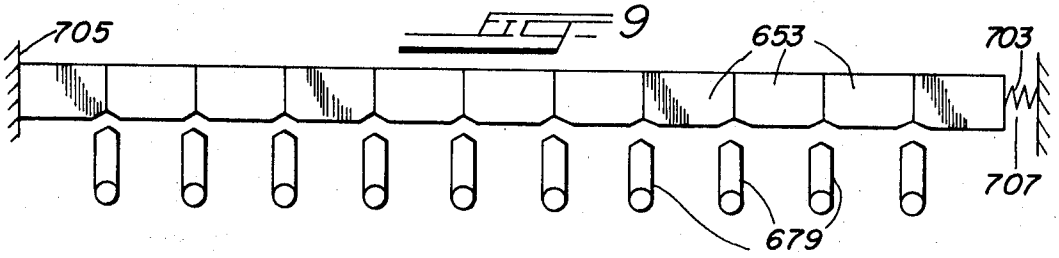


FIG 9A

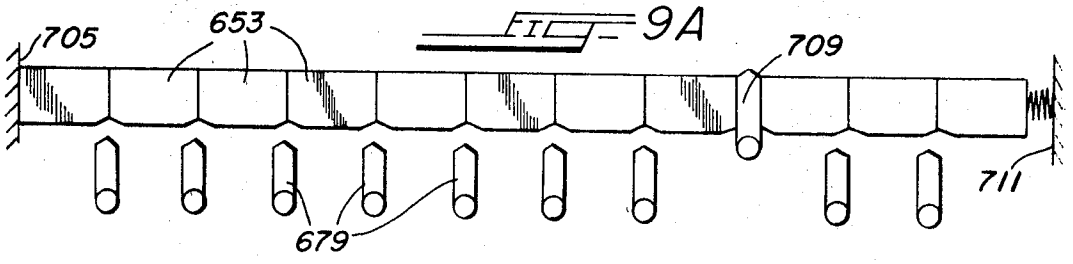


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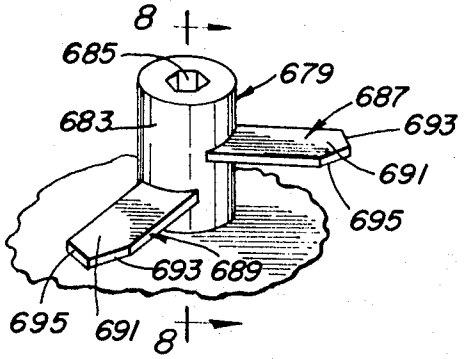


FIG 8

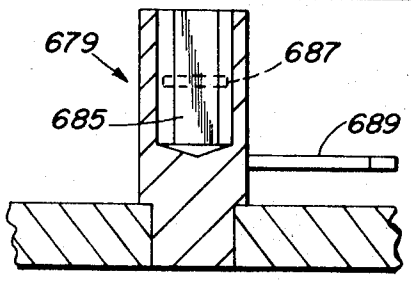
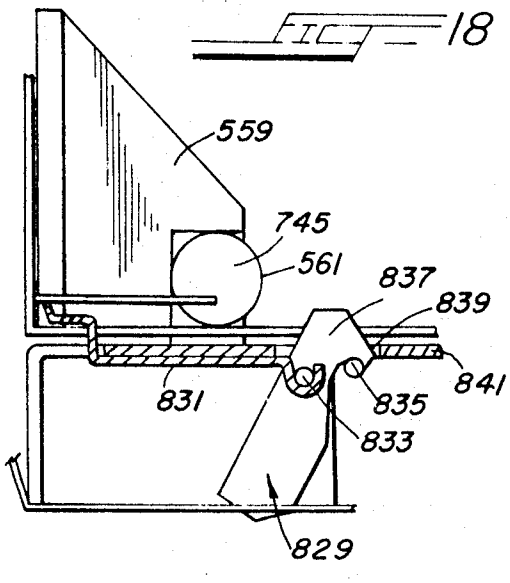
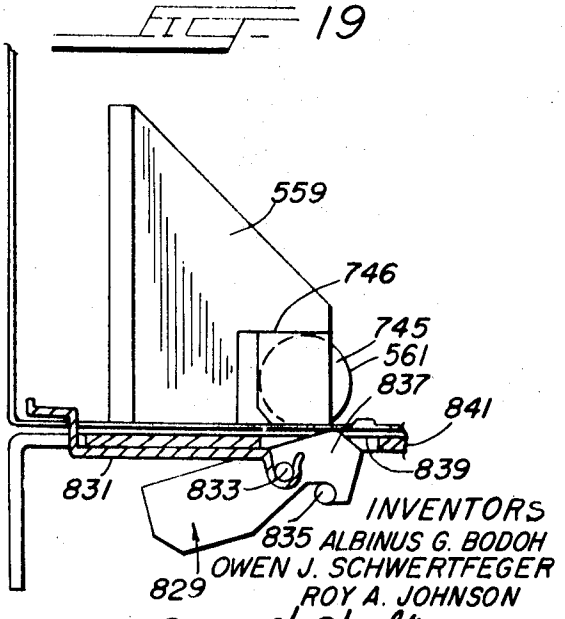


FIG 19

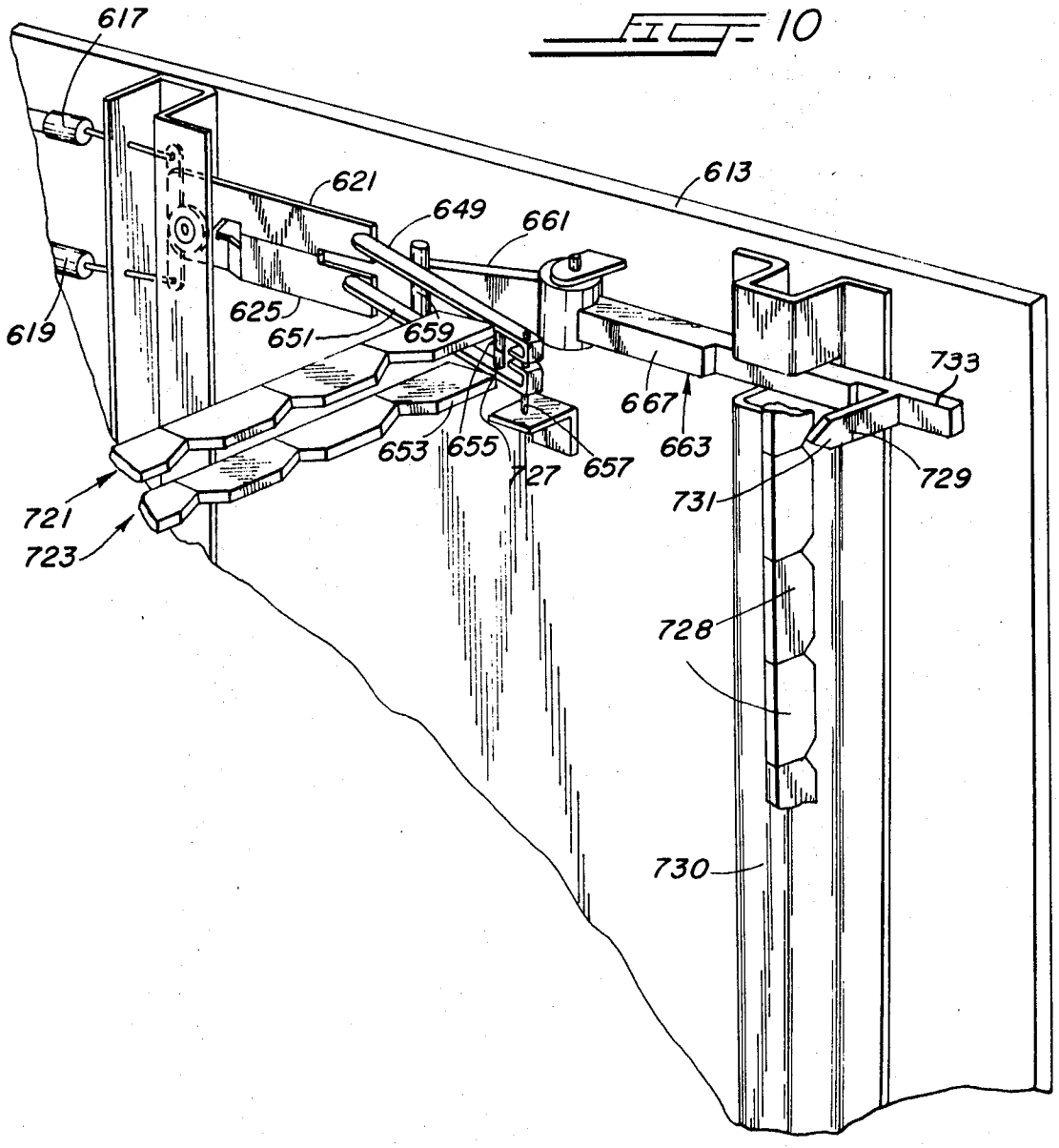
FIG 18





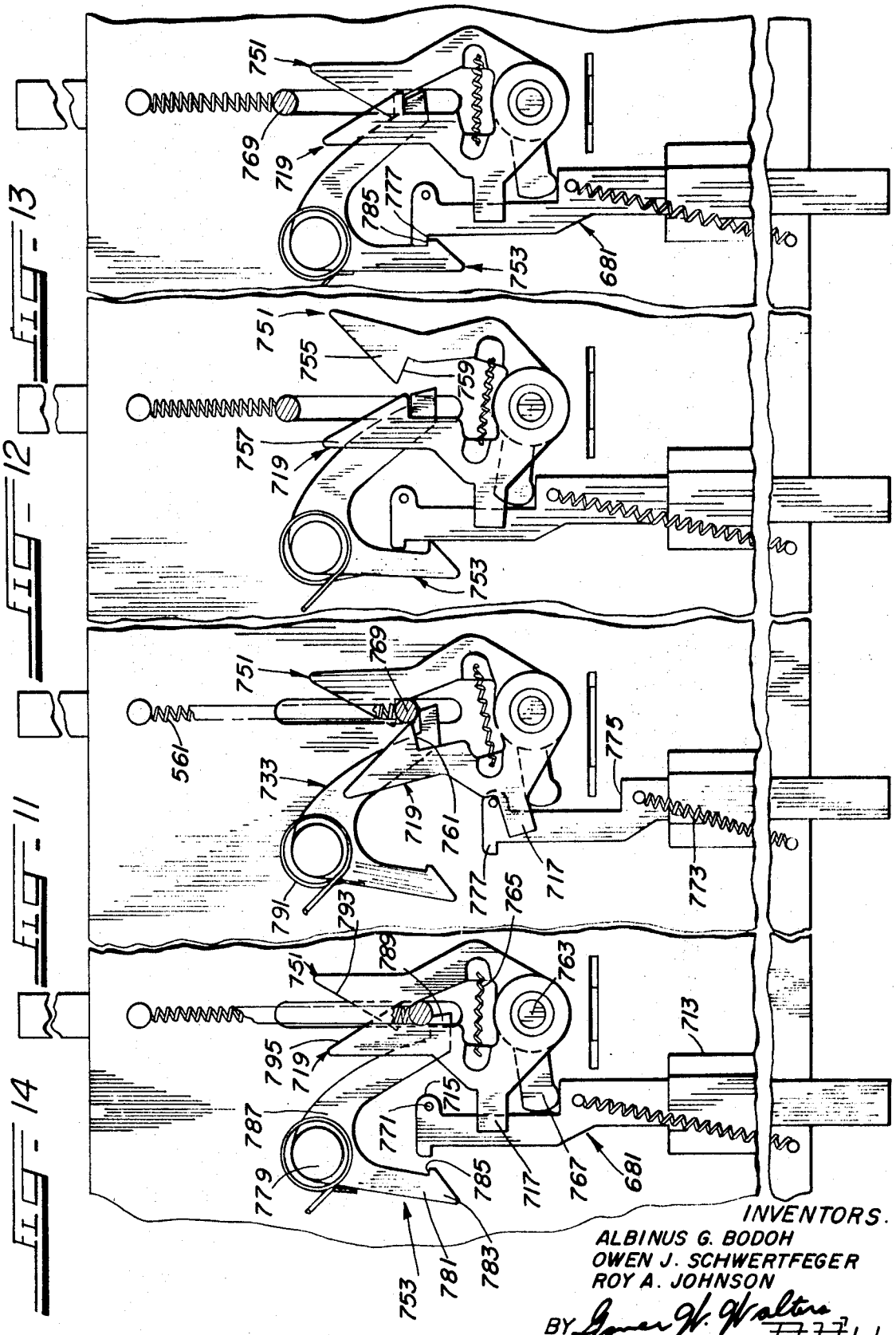
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FIG. 10



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FIG. 15

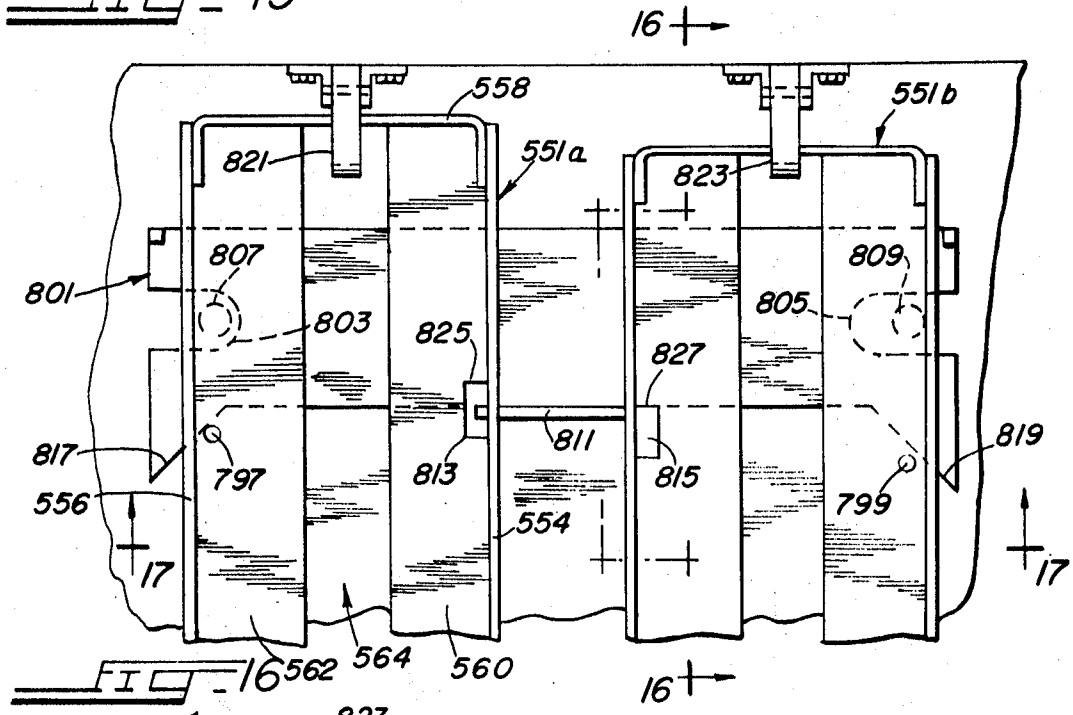


FIG. 16

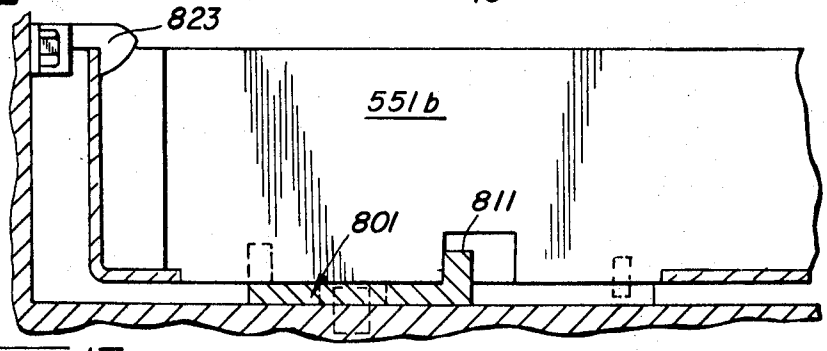
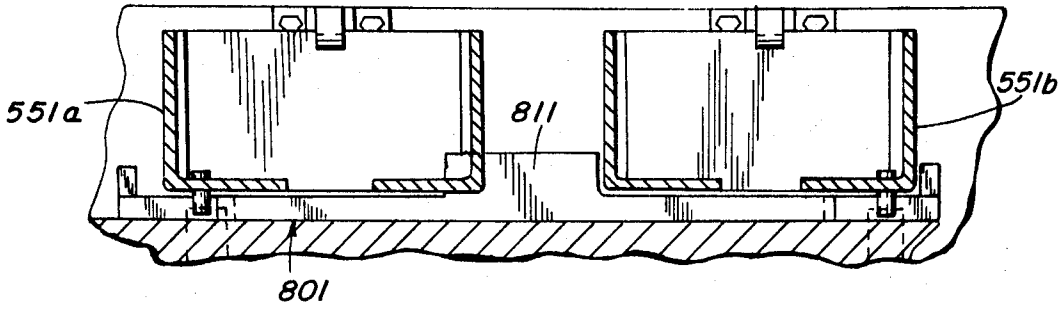


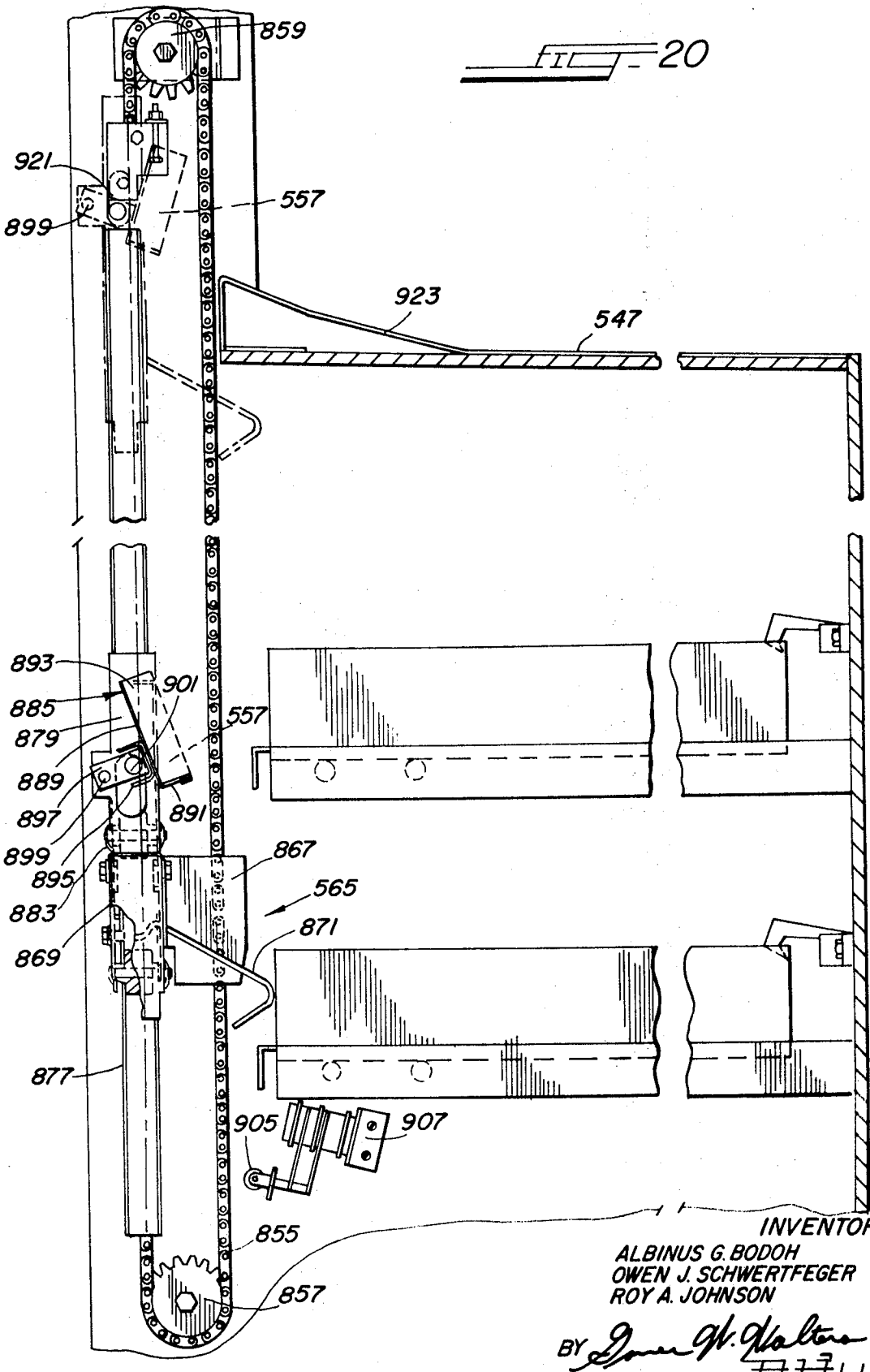
FIG. 17



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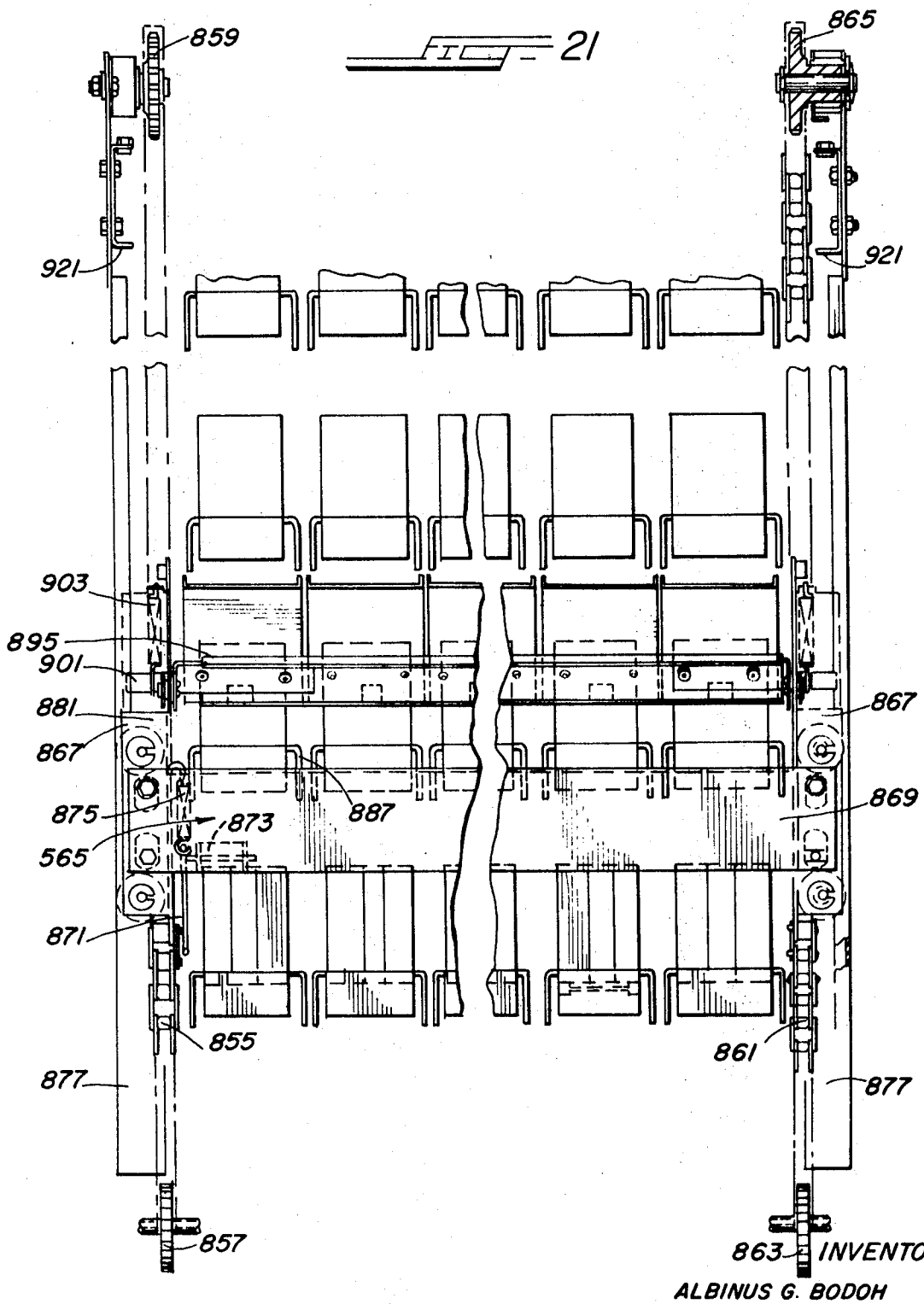
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FIG. 20



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FIG. 21



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FIG. 22

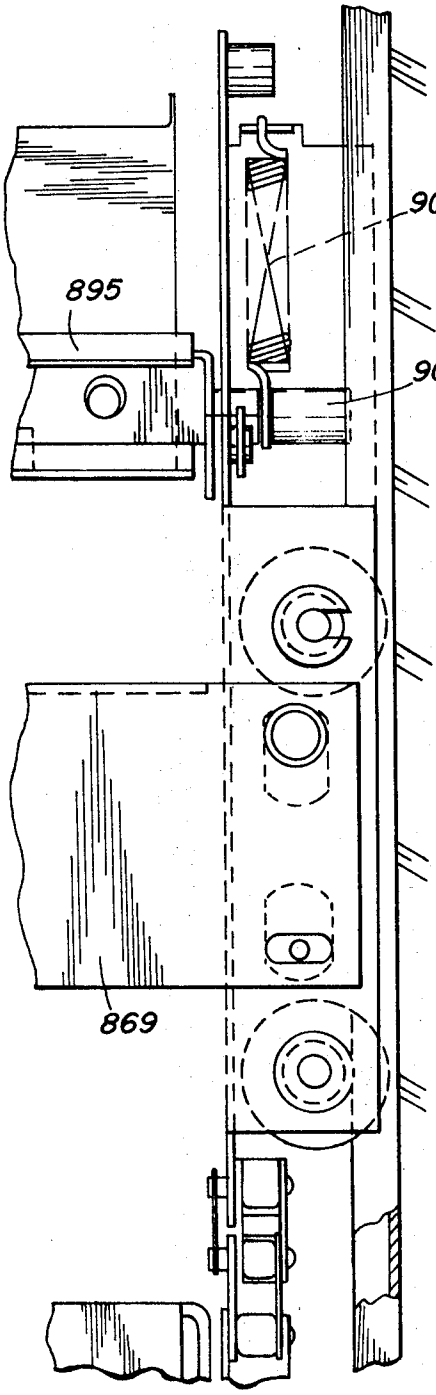
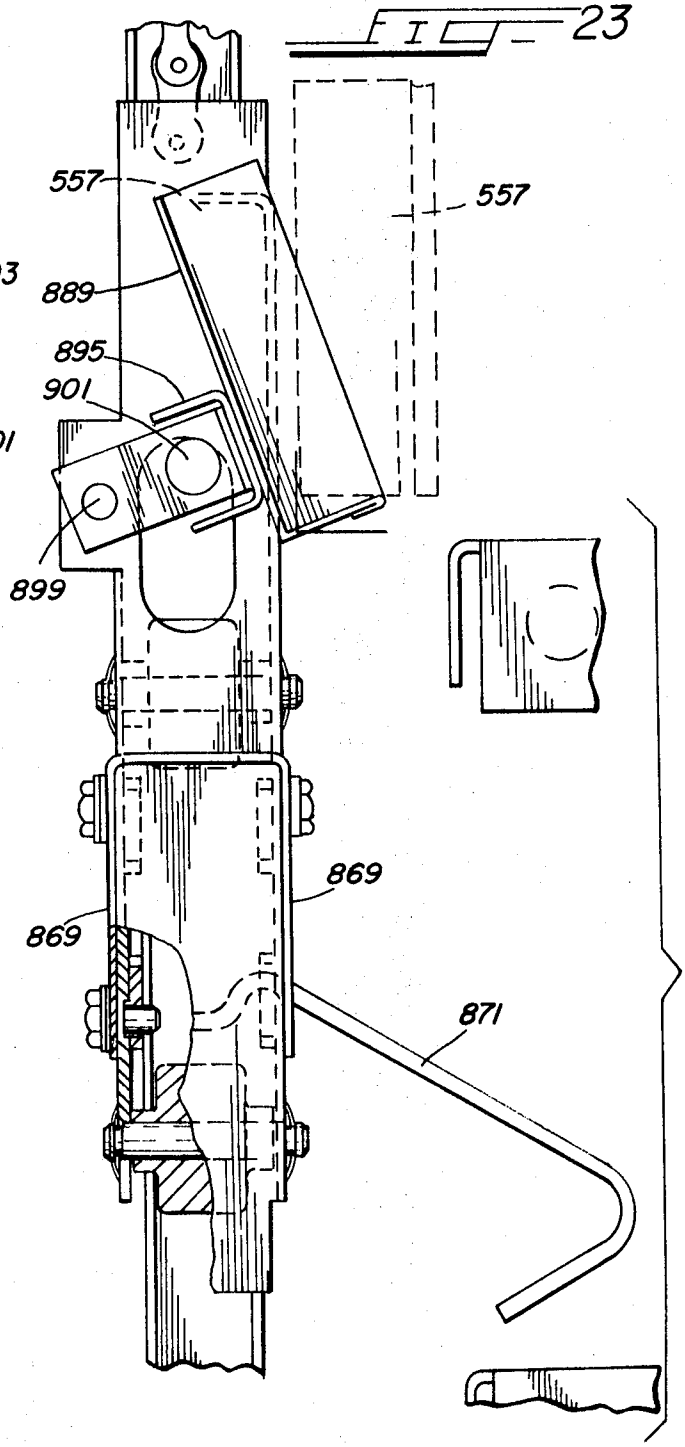


FIG. 23



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FIG 24

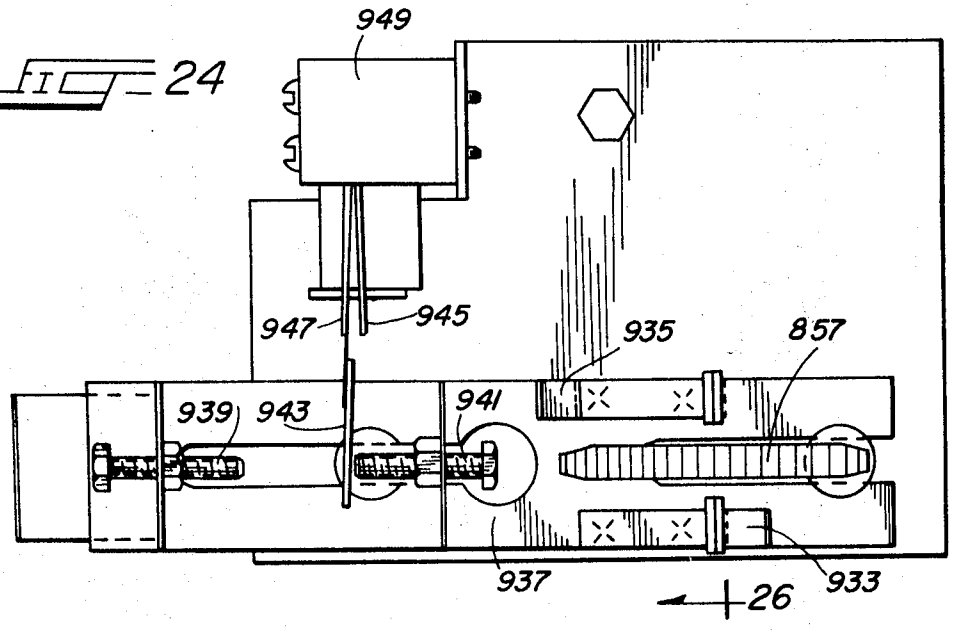


FIG 25

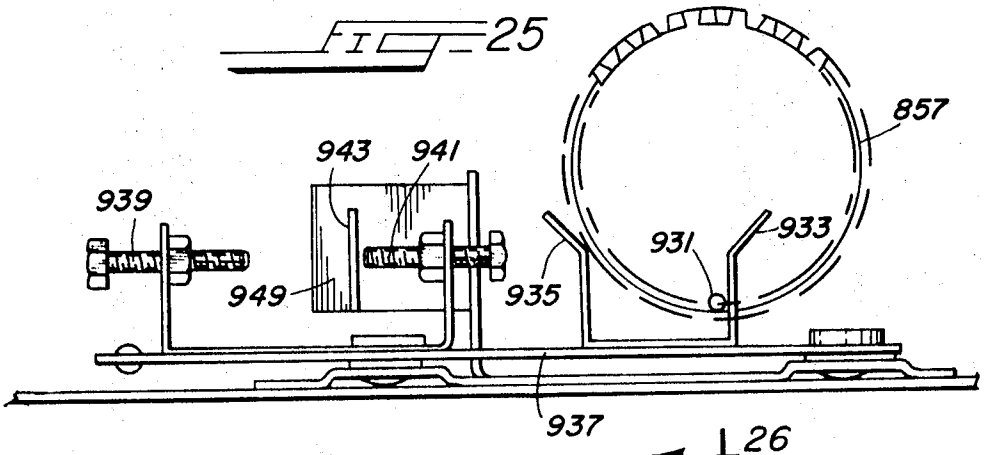
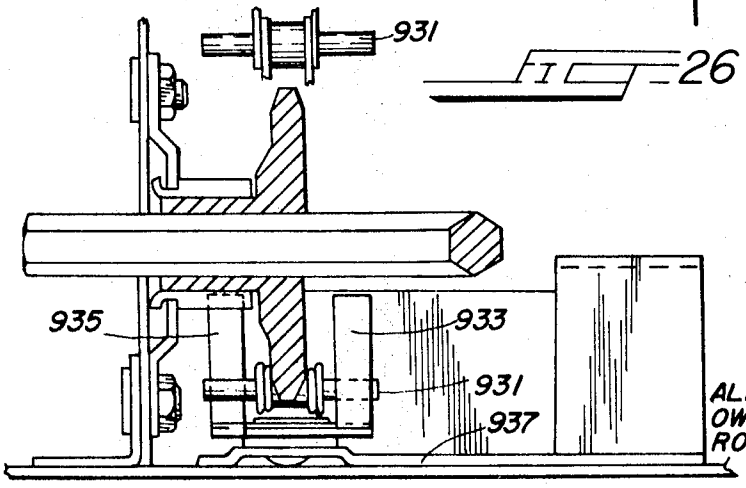


FIG 26



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FIG - 28

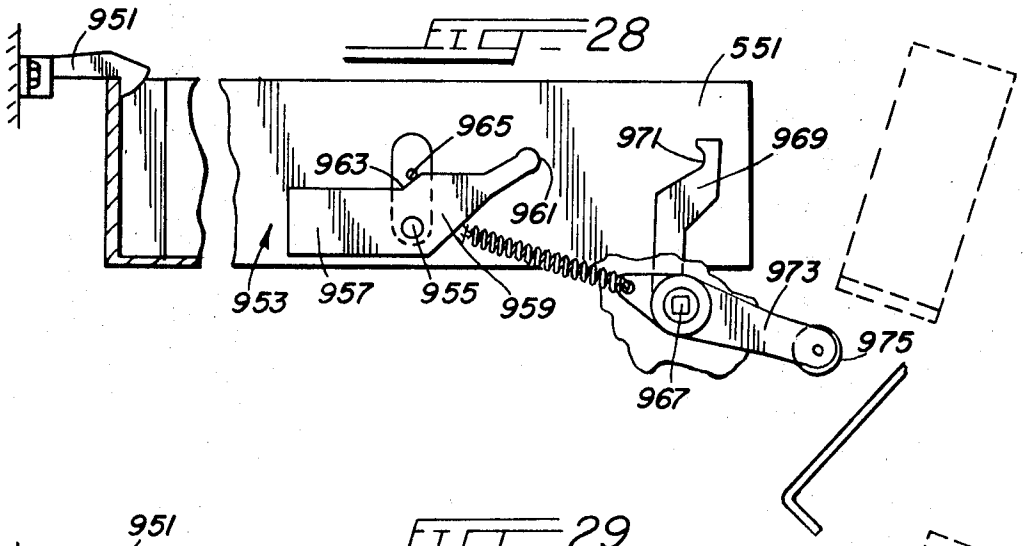


FIG - 29

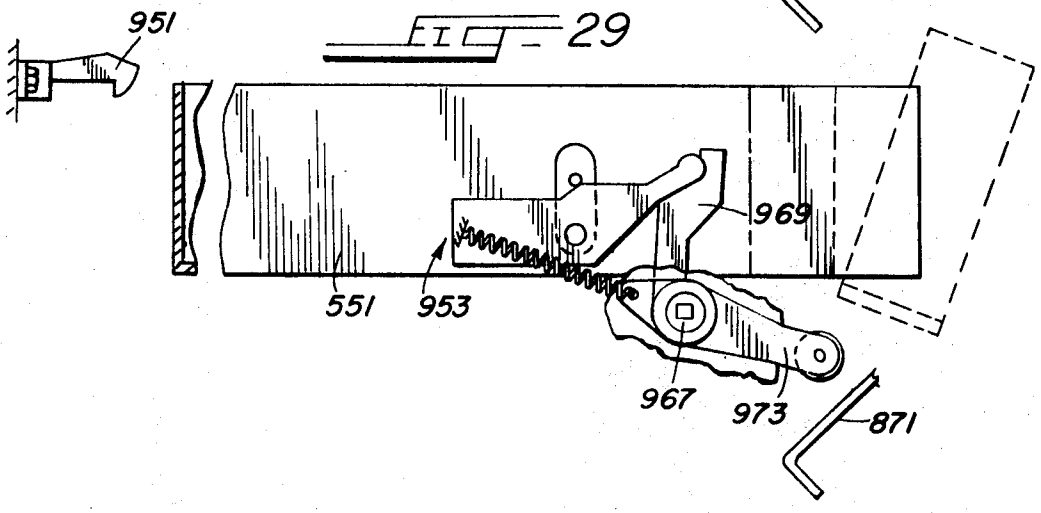
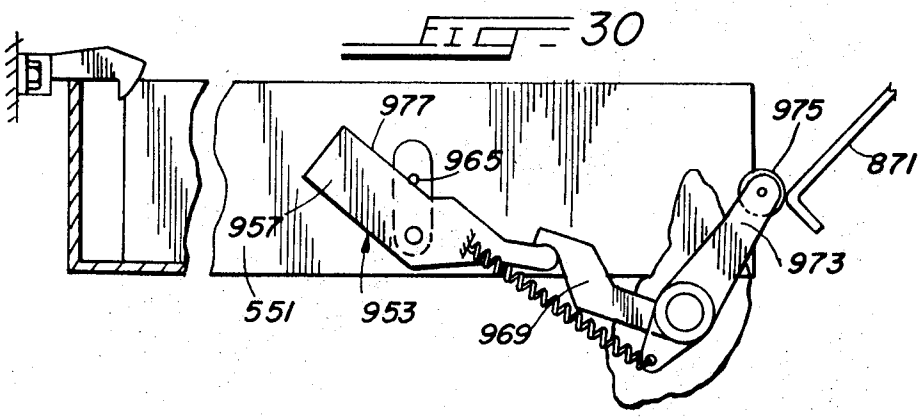


FIG - 30



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BY Gomer W. Walton Atty.

FIG. 32

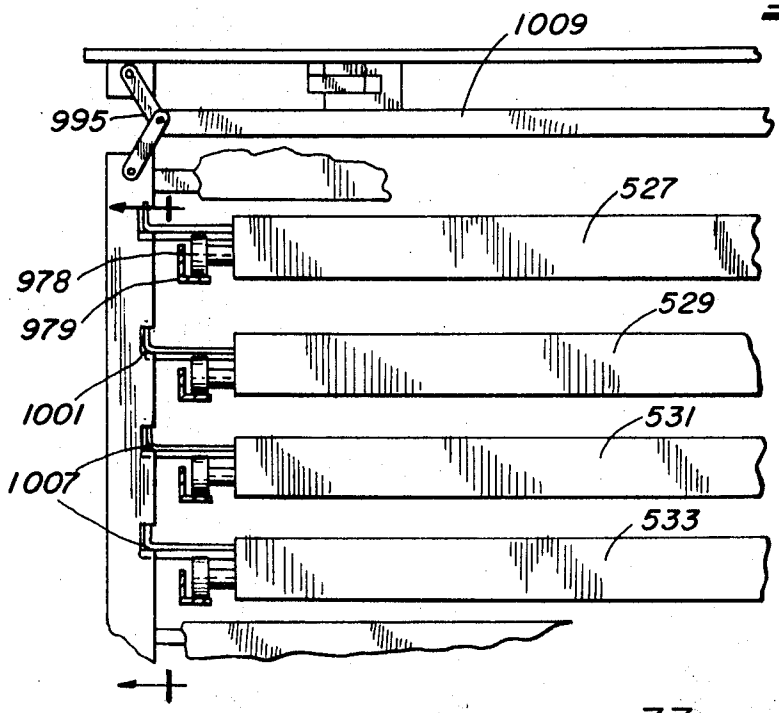


FIG. 35

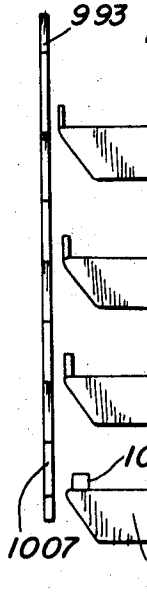


FIG. 36

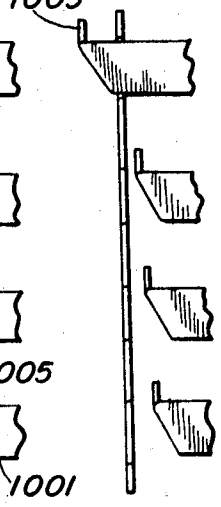


FIG. 33

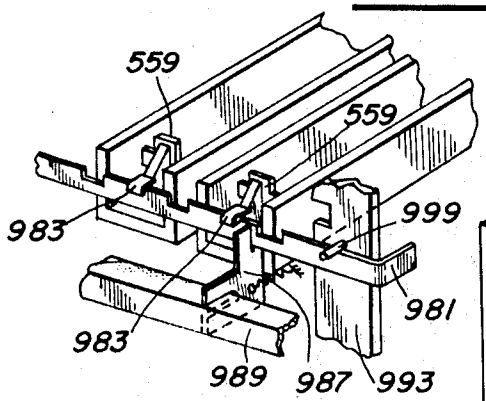
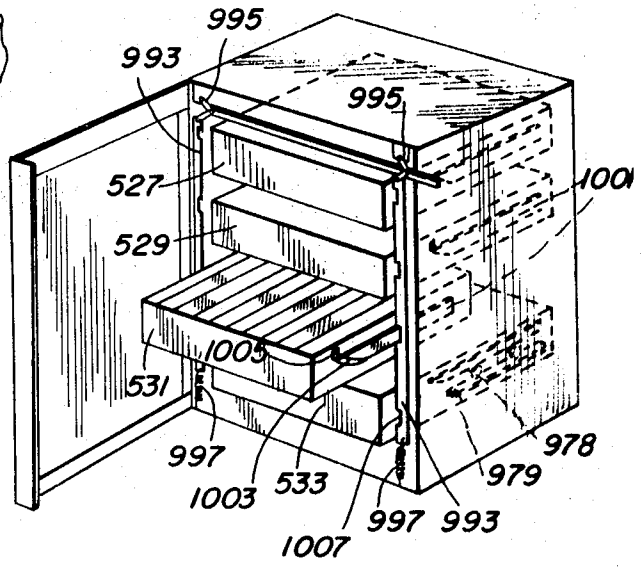


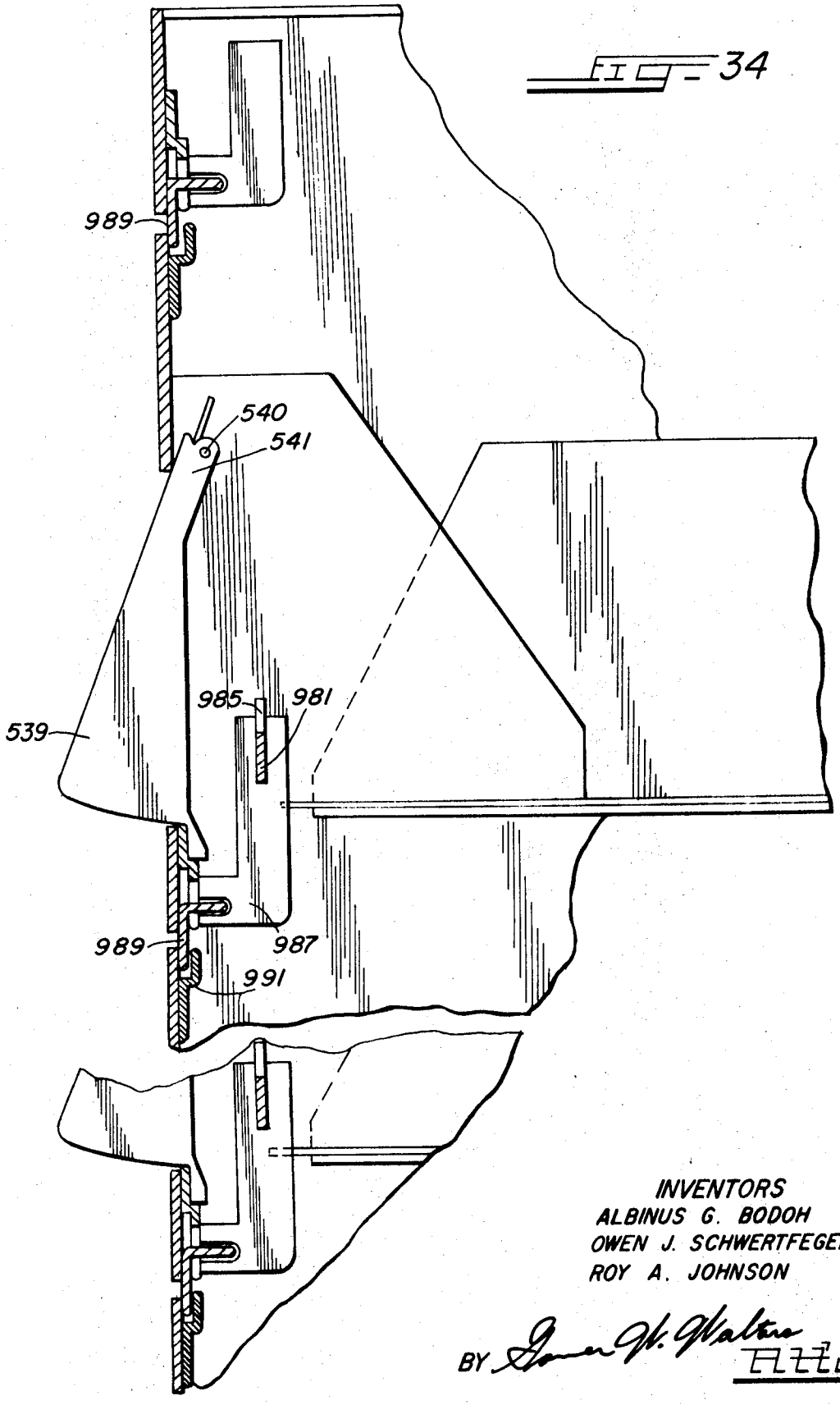
FIG. 31



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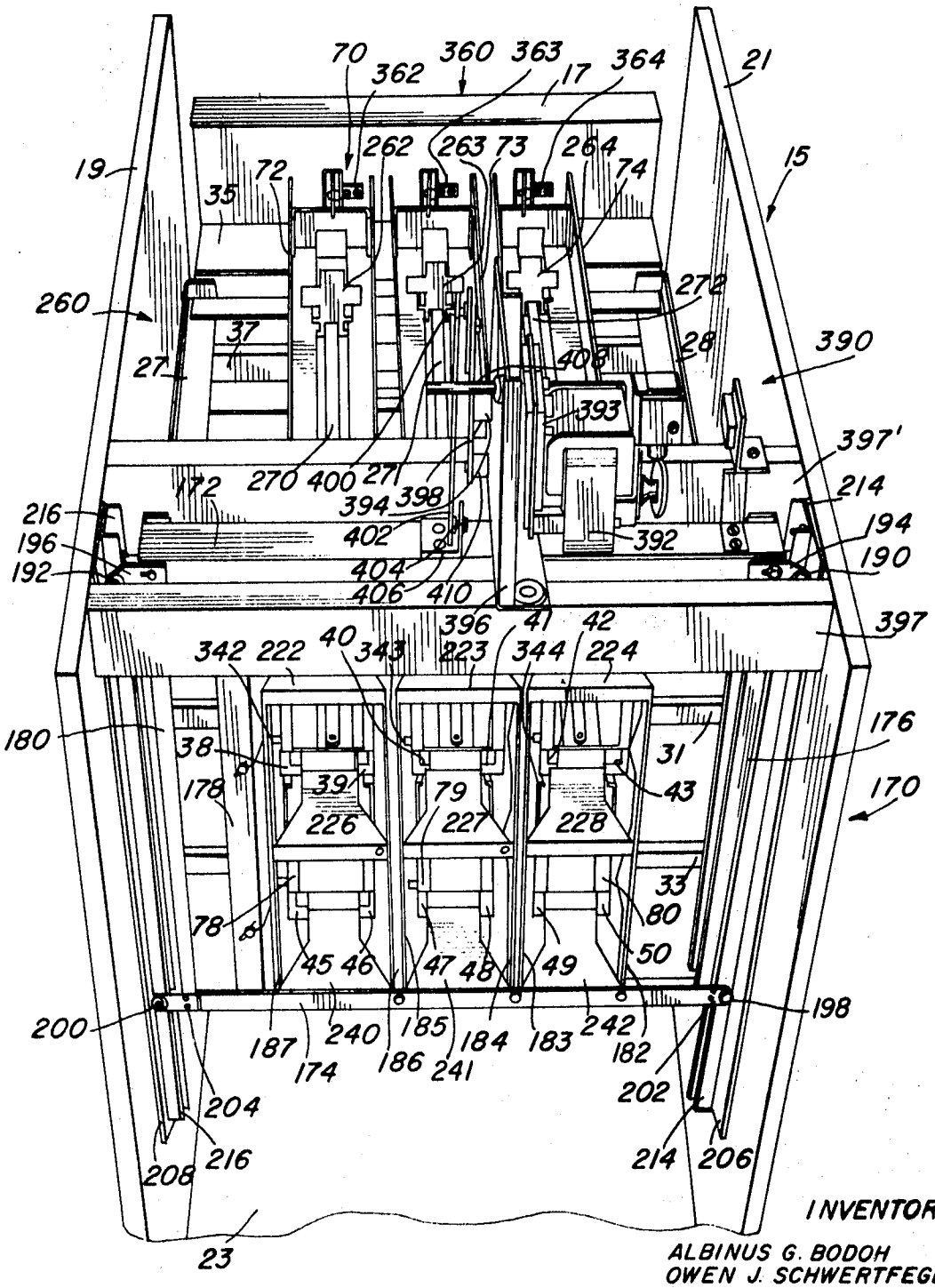
FIG - 34



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FIG-37



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FIG 38

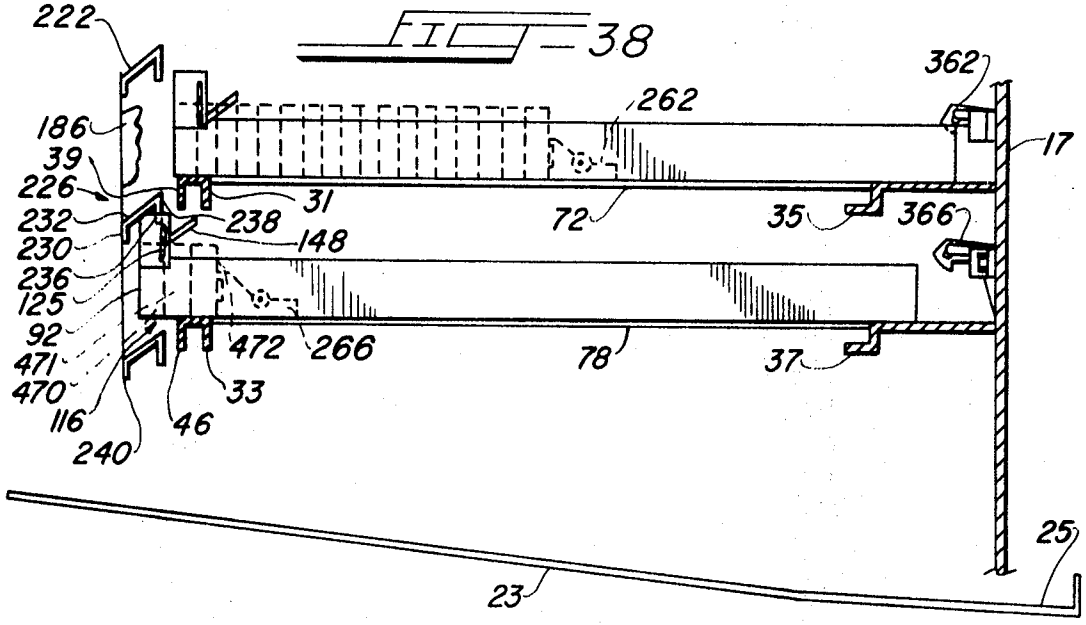


FIG 39

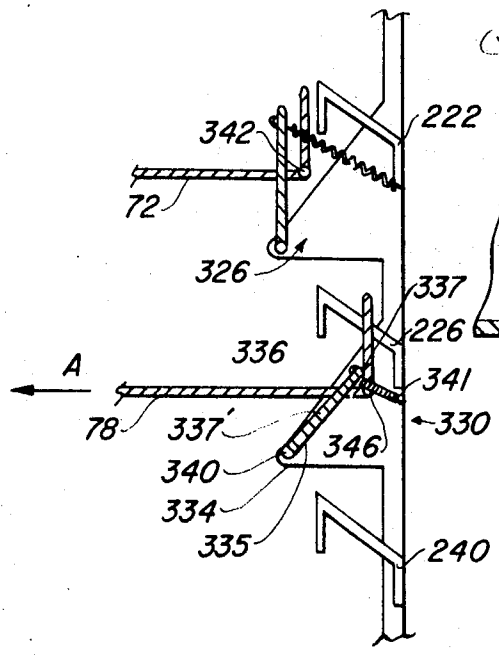
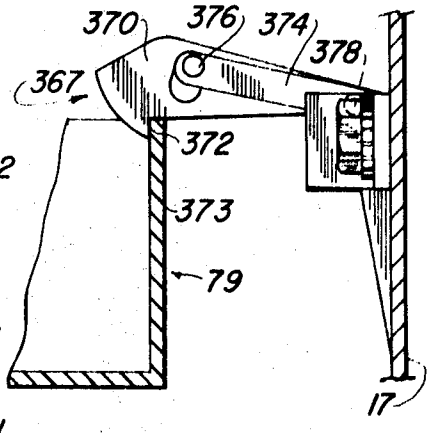


FIG 40



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FIG - 41

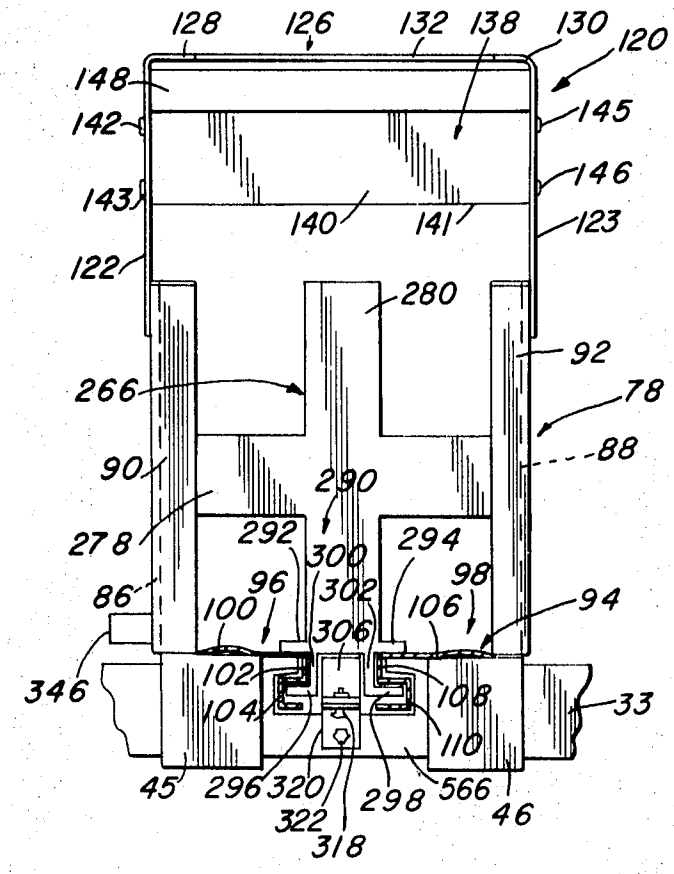
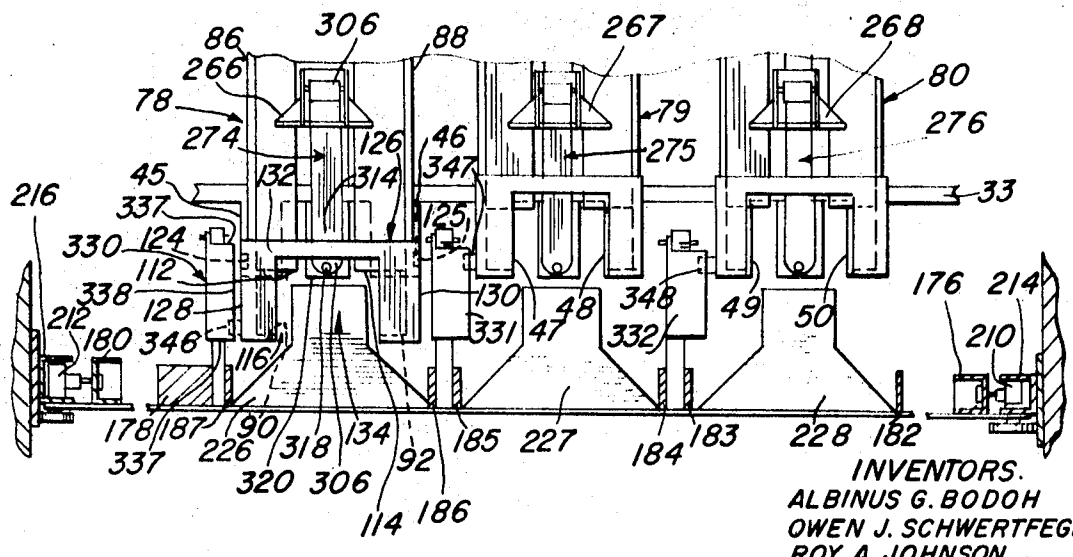


FIG - 42



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BY Glenn H. Walters
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FIG. 43

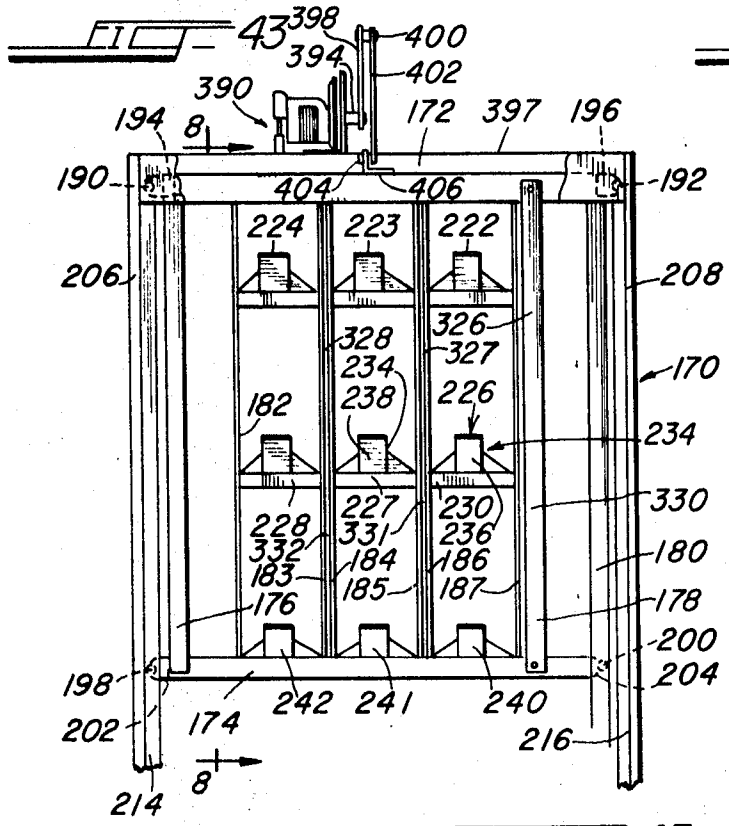


FIG. 44

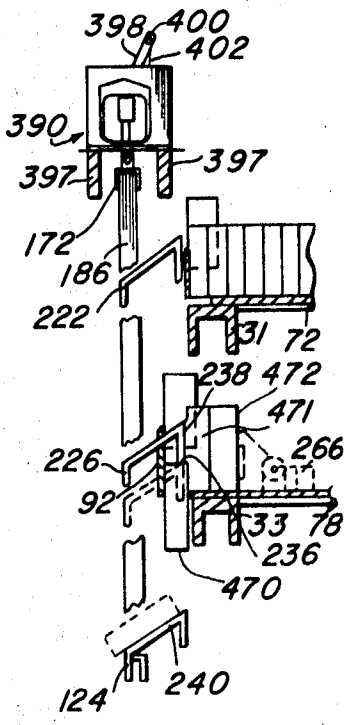
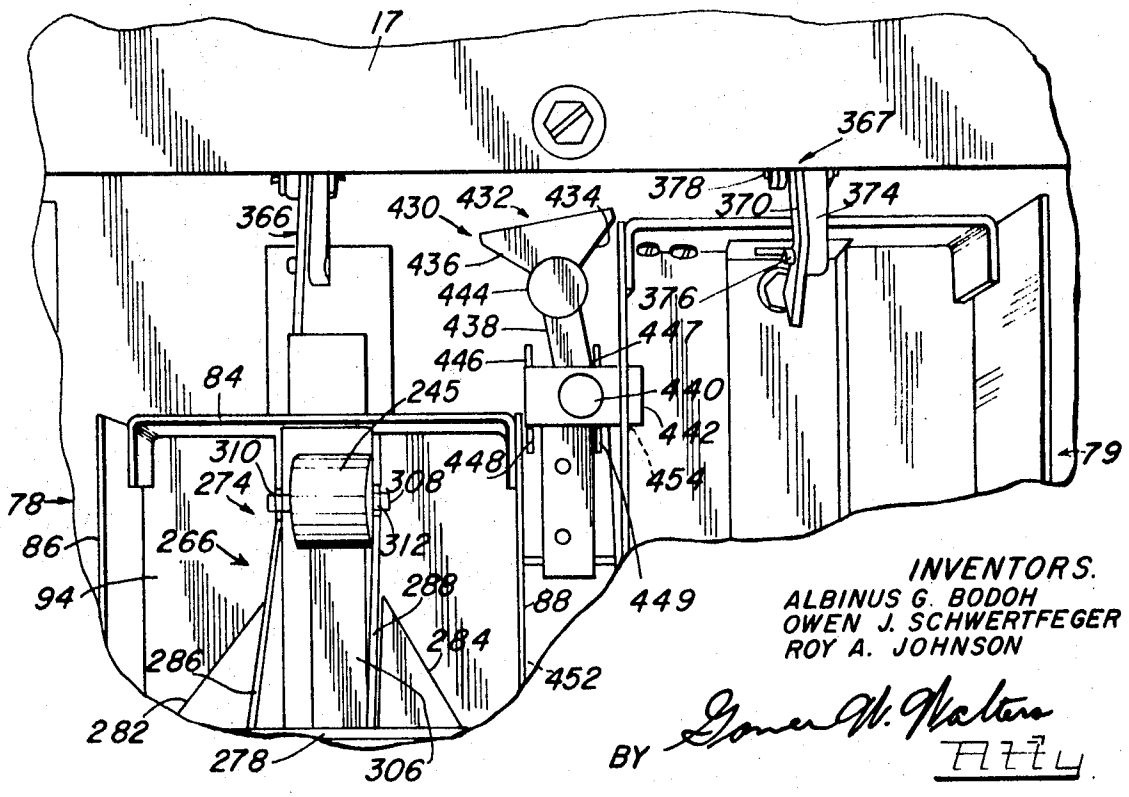


FIG. 45



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BY Gomer W. Walters
Atty

FIG. 46

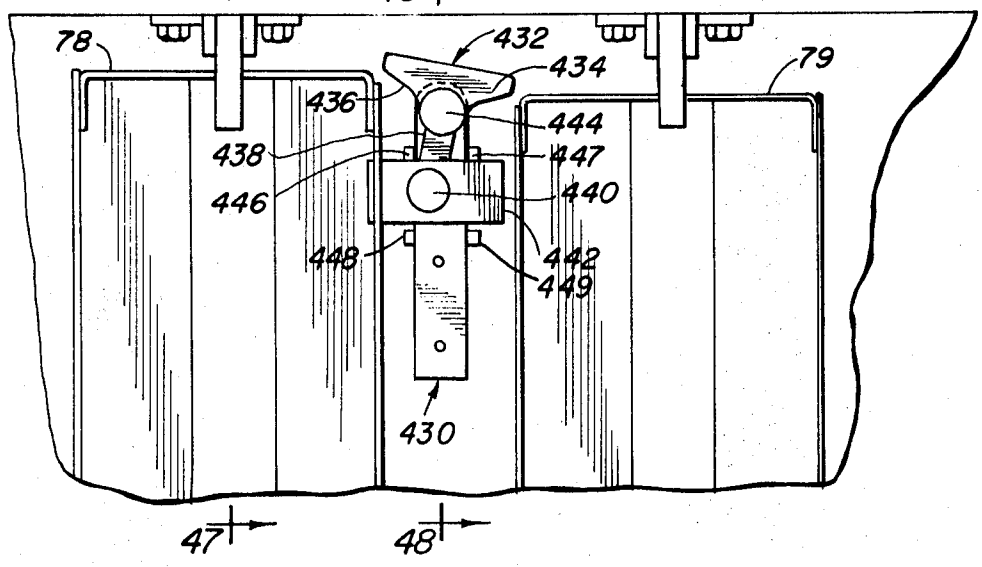


FIG. 47

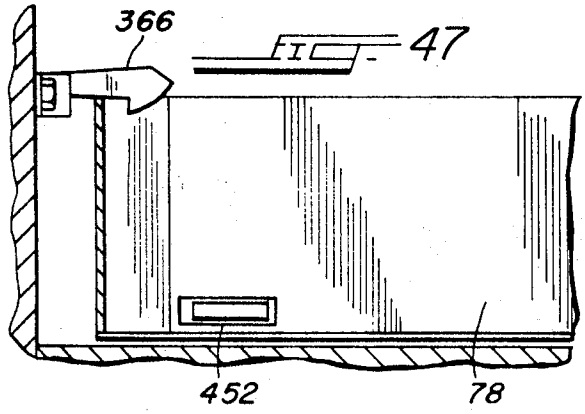
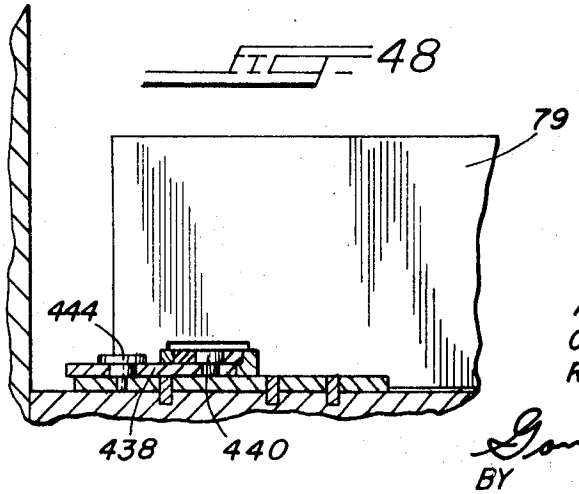


FIG. 48



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ARTICLE-VENDING APPARATUS UTILIZING DISPLACEABLE ARTICLE-CONTAINING TRANSPORT MEMBERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention generally relates to an article-vending apparatus, and more specifically this invention relates to a cigarette-vending machine having movable horizontal trays.

2. Description of the Prior Art

There are many types of cigarette vendors now being utilized or that have been used in the past. One feature of the prior art machines is that the cigarettes to be dispensed are stored in vertical columns. Dispensing is achieved by removing either the top or the bottom package. There are various mechanisms to achieve removal of the top or bottom package. One of the earliest is a simple bottom dispensing type utilizing a simple mechanical structure which is actuated by a customer pulling a lever. In other devices, the removal of a package of a selected brand of cigarettes is achieved by utilizing electromechanical elements. In all of the prior art cigarette venders, regardless of whether they are of the top dispensing or the bottom dispensing type, there are many problems that have not been adequately solved.

Perhaps the most serious difficulty of these prior art devices is the limited capacity that may be achieved. Since the packages are stored in vertical columns, the only manner in which capacity can be increased is to increase the height of the machine or to increase the width of the machine. Both of these alternatives are generally unacceptable to purchasers of the machine. A third possibility would be to provide another vertical plane of columns behind the first vertical plane of columns, but this approach involves so many problems that it has generally been recognized as being unfeasible. A corollary of the limited capacity objection is that there are a limited number of choices which may be provided. As the packages are stored in vertical columns, the majority of the storage space occurs in the relatively long spans in the vertical direction. To increase the number of choices available to a customer, the size of the machine would have to be greatly expanded, which would result in the same disadvantages involved in an increase in capacity. Since modern customer preferences and modern merchandising techniques tend toward the provision of a multiplicity of choices, the prior art cigarette vendors tend to be somewhat outmoded.

Another serious problem with prior art devices is that the package removal area is at the front of the machine, and thus is generally accessible to the customers or others at the vending location. Although many methods are utilized to limit the accessibility of the removal area, the "cheating" factor is still an important consideration in the cigarette-vending field.

Still another problem with prior art cigarette-vending arrangements is that the size of the vertical columns must be carefully adjusted for the particular type of cigarette package to be dispensed therefrom (i.e., regular, king size, or extra long). Due to the requirements for an accurate fit of the cigarette package to be dispensed in the vertical column, there can be no interchangeability between columns. This is a serious disadvantage, as it limits the capability of the machine to be utilized effectively during short period fluctuations in customer demand.

There are also other difficulties inherent in the relatively complex doors that must be utilized and which are adapted to carry many of the important elements of the vending apparatus. The difficulty with these doors lies in the large number of moving parts and the difficulty of protecting these parts when they are mounted on a moving door. Other difficulties associated with the cabinet structure utilized in vertical column dispensing is that the columns are difficult to load, as the service man must hold down the plunger which forces the cigarette packages either upwardly or downwardly, depending upon whether top or bottom dispensing is utilized, and stuff the new packages in with his other hand. Not only does this create problems by extending the time that the service man must spend in reloading the machine, but due to the difficulty in performing the loading there is more chance that a package will not be properly fit into the column so that the machine might be jammed. Still another disadvantage of the vertical column cigarette vending cabinet is that the columns are rigidly mounted and difficult to service.

Besides the general disadvantages of vertical column dispensing, whether of the top or bottom variety, there are other disadvantages that are peculiar to one or the other type of dispensing. For instance, top dispensing vertical column apparatuses have the disadvantage that loading of the columns is performed by adding new packages at the top (as is also the case with bottom dispensing devices) so that the first packages dispensed are those most recently introduced into the machine (i.e., "last in - first out"). Therefore, the packages at the bottom of the column can remain in the machine for relatively long periods and become stale.

As an example of the type of problem peculiar to a bottom removal type of dispenser, there are the disadvantages that the customer must stoop over to pick up the dispensed package and that a complicated mechanical interlock is required to permit vending of a selected brand of cigarettes without having the remainder of the packages in the column gravity ejected.

Apparently, there has been some effort in the past to utilize horizontally disposed vending columns, but these approaches purportedly involved the use of individual motors and elevator mechanisms for each vertically aligned series of horizontal columns. Besides the prohibitive cost of the multiple motor-elevator arrangements, there seems to have been a number of mechanical problems that rendered this approach completely unfeasible.

SUMMARY OF THE INVENTION

The present invention relates to an article-vending apparatus, with particular applicability to the cigarette-vending field, that utilizes horizontally disposed movable trays that overcome many of the prior art disadvantages. Briefly, in the preferred embodiments described herein, the present invention relates to an article-vending machine that has components thereof stored in horizontally slidable drawers. A series of transport members, hereinafter referred to as trays, have the articles to be vended located thereon. The trays are horizontally positioned in the slidable drawers and are adapted for reciprocable longitudinal motion between a rest position and a vend position. Although a horizontal disposition of the movable trays provides certain benefits in the cigarette-vending field, it should be realized that the movable tray concept could be equally well utilized with a vertical motion to produce a number of advantages over prior art devices. The trays are normally latched in the rest position, but are biased toward the vend position. A pusher element is located at the front of the trays and connected to a constant force spring that biases the articles in the tray toward the rear thereof. This constant force spring also serves as an actuating means to drive the trays toward the rear of the cabinet. When a tray has been driven to the rear of the cabinet, the rearmost article thereon is placed in a vend area. An extracting apparatus, which may take the form of either a single upwardly moving elevator mechanism or downwardly moving screen, acts to remove the rearmost article from the tray and transport it to a dispensing area. After the article has been removed from the tray, the tray is returned to the rest position where it is latched again.

The structure and operation described above indicate that the present invention obviates many of the problems associated with prior art vending machines. The dispensing apparatus of this invention has an extremely large capacity and illustrates maximum utilization of the available space within the vending machine cabinet. Furthermore, the use of a relatively large number of relatively short trays permits dispensing

in accordance with modern marketing practice and modern consumer preference by providing a large number of choices. Since the vend area is at the rear of the machine, it is practically impossible for someone to reach the removal apparatus, and hence the possibility of "cheating" is greatly reduced. Due to the fact that there is no necessity for critical dimensions, the trays may be interchangeably utilized for different size articles (e.g., in the case of cigarettes, regular, king size, or extra long cigarette packages may all be dispensed from any of the trays). Loading of the trays is greatly simplified, since the service man need only pull out a drawer and insert the articles to be vended in front of the pusher element, which may be latched on the front of the drawer during loading. Since the fresh articles are placed in the front of the trays, and a vending occurs by removal from the rear of the trays, a desirable "first in—first out" sequence of operation is realized. The trays are removable so that service and repair of any inoperative tray is extremely simple. In addition, if a part is needed and is not readily available, the inoperative tray may be removed and the rest of the system may operate without any impairment. Also, since most of the elements may be stored in the drawers, it is possible to greatly reduce the amount of material located on the door and hence greatly reduce the problems associated with having essential functions carried out by apparatus positioned on the door. The vending apparatus of this invention is relatively inexpensive to manufacture, especially when viewed in light of its large capacity, and the relatively noncomplex, primarily mechanical structure results in very few maintenance problems, and hence very little down time.

Accordingly, it is a primary object of this invention to provide an article dispensing apparatus that has a large capacity but is relatively inexpensive to manufacture and maintain.

Another object of this invention is to provide an article-dispensing apparatus that provides a large number of customer choices in accordance with modern consumer preferences and modern marketing practices.

Yet another object of this invention is to provide an article-dispensing apparatus that is relatively free of maintenance problems and that is easy to service if a problem should arise.

Still another object of this invention is to provide an article-dispensing apparatus that is difficult, if not impossible, to cheat.

A further object of this invention is to provide an article-dispensing apparatus having trays in which articles having a variety of sizes may be located for dispensing.

Yet a further object of this invention is to provide an article-dispensing apparatus in which the first articles placed in the machine are the first dispensed by the machine.

Still a further object of this invention is to provide an article-vending apparatus in which a majority of the operative parts may be located in a movable drawer.

Another object of this invention is to provide an article-dispensing apparatus utilizing horizontal trays in which a single movable ejecting apparatus may be utilized to extract a selected article for vending from the tray in which it is located.

These and other objects, advantages, and features of the subject invention will hereinafter appear, and for purposes of illustration, but not of limitation, exemplary embodiment of the subject invention are shown in the appended drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a right front perspective view of a vending machine incorporating a preferred embodiment of this invention.

FIG. 2 is a left rear perspective of a portion of the internal structure of a vending apparatus constructed in accordance with the principles of this invention.

FIG. 3 is a schematic circuit diagram utilized in a preferred embodiment of this invention.

FIG. 4 is a top plan view of a portion of a vending apparatus credit lockout arrangement utilized in a preferred embodiment of this invention.

FIG. 5 is a side elevational view of the apparatus illustrated in FIG. 4.

FIG. 6 is an enlarged top plan view of a selecting and lockout arrangement utilized in a preferred embodiment of this invention.

FIG. 7 is a perspective view of a rotatable sliding actuator utilized in a preferred embodiment of this invention.

FIG. 8 is a cross sectional view taken along line 8—8 of FIG. 7.

FIGS. 9 and 9A are schematic representations of the operation of a lockout arrangement utilized in a preferred embodiment of this invention.

FIG. 10 is a perspective view of portions of interrelated lockout arrangements utilized in a preferred embodiment of this invention.

FIGS. 11–14 are top plan views illustrating various positions of a latching arrangement utilized in a preferred embodiment of this invention.

FIG. 15 is a top plan view of an alternating latch arrangement utilized in a preferred embodiment of this invention.

FIG. 16 is a cross-sectional view taken along line 16—16 of FIG. 15.

FIG. 17 is a cross-sectional view taken along line 17—17 of FIG. 15.

FIG. 18 is a side elevational view of a sold-out lockout arrangement utilized in a preferred embodiment of this invention.

FIG. 19 is a side elevational view similar to that of FIG. 18 but illustrating the lockout mechanism at another point in its operation.

FIG. 20 is a partial side cross-sectional view of an elevator mechanism utilized in a preferred embodiment of this invention.

FIG. 21 is a rear cross-sectional view of the elevator mechanism illustrated in FIG. 20.

FIG. 22 is an enlarged view of the right central portion of the elevator mechanism illustrated in FIG. 21.

FIG. 23 is an enlarged view of the portion of the elevator mechanism illustrated in the left central part of FIG. 20.

FIG. 24 is a top plan view illustrating a motor-reversing switch arrangement utilized in a preferred embodiment of this invention.

FIG. 25 is a side elevational view of the mechanism illustrated in FIG. 24.

FIG. 26 is a cross-sectional view taken along line 26—26 of FIG. 25.

FIG. 27 is a schematic side view illustrating the operation of a preferred embodiment of this invention.

FIG. 28 is a partially broken away side view of a tray reset mechanism utilized in a preferred embodiment of this invention.

FIGS. 29 and 30 illustrate other positions of the reset mechanism illustrated in FIG. 28.

FIG. 31 is a top left front perspective view of an open vending machine incorporating a preferred embodiment of this invention.

FIG. 32 is an enlarged partial front view of the vending apparatus illustrated in FIG. 31.

FIG. 33 is a perspective view illustrating features of a pusher-element-latching and drawer interlock system utilized in a preferred embodiment of this invention.

FIG. 34 is an enlarged partial cross-sectional view illustrating a selector button in which the relationship of the button pusher latch and drawer interlock system illustrated in FIG. 33 is depicted.

FIG. 35 is a schematic view illustrating the operation of a second drawer interlock arrangement utilized in a preferred embodiment of this invention.

FIG. 36 is a view similar to FIG. 35 illustrating the mechanism at a second position in its cycle of operation.

FIG. 37 is a top front perspective view of a vending machine apparatus incorporating a second embodiment of this invention.

FIG. 38 is a partial cross-sectional view illustrating the operation of the embodiment of this invention illustrated in FIG. 37.

FIG. 39 is an enlarged cross-sectional view illustrating a tray reset arrangement utilized with the embodiment of this invention illustrated in FIG. 37.

FIG. 40 is an enlarged cross-sectional view of a latching arrangement utilized with the embodiment of this invention illustrated in FIG. 37.

FIG. 41 is an enlarged rear elevational view of a pusher and tray arrangement utilized with both embodiments of this invention.

FIG. 42 is an enlarged top plan view of a portion of the extracting apparatus utilized with the embodiment of this invention illustrated in FIG. 37.

FIG. 43 is a partially broken away rear plan view of an apparatus according to the embodiment of this invention illustrated in FIG. 37.

FIG. 44 is an enlarged side cross-sectional view schematically illustrating the ejecting action of the embodiment of this invention illustrated in FIG. 37.

FIG. 45 is an enlarged top plan view of an alternating mechanism utilized in the embodiment of this invention illustrated in FIG. 37.

FIG. 46 is a top plan view of the alternating arrangement illustrated in FIG. 45 with some of the elements removed.

FIG. 47 is a cross-sectional view taken along line 47—47 of FIG. 46.

FIG. 48 is a cross-sectional view taken along line 48—48 of FIG. 46.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings, a perspective view of the cabinet of an article-vending machine appears in FIG. 1. Although the invention hereof has application in many other environments, this description will proceed with specific reference to a cigarette-vending machine 525.

Cigarette-vending machine 525 has four vertically displaced drawers 527, 529, 531, and 533. A separate door panel 535 includes coin-receiving mechanism adapted to be energized by the deposit of coins. Each of the drawers 527, 529, 531, and 533 has a series of selector buttons 539 located thereon. Selector buttons 539 are pivotally mounted on a pivot 540 at the upper ends 541 thereof to permit actuation by a customer. Each of the selector buttons carries a replica of a brand of cigarettes. Upon actuation by a customer making a selection, selector buttons 539 pivot about the mounting on the upper end thereof and produce longitudinal movement of an actuating mechanism engaged thereby.

At the sides of the cigarette vender there are solid metallic frame structures 543 and 545. A dispensing area 547 is located on top of the vending machine between shoulder and waist height. A vertically projecting panel 549 upon which various displays may be placed is located above the dispensing area 547.

The perspective view of FIG. 2 illustrates the internal composition of cigarette-vending machine 525. Each of the drawers 527, 529, 531, and 533 corresponds to a shelf level in cigarette-vending machine 525 on which are located a series of article-containing trays 551 that are mounted for reciprocable longitudinal movement with respect to the shelves. Trays 551 are located in channels formed by guides 552. As may be seen in FIGS. 15 and 16, trays 551 have sidewalls 554 and 556 and an end wall 558. A bottom of trays 551 is formed by two bottom portions 560 and 562. Due to the spacing between portions 560 and 562, a longitudinal gap 564 is left in the bottom of tray 551. As may be seen in FIG. 41, a matching channel 566 is formed in the shelf below gap 564. Bottom portions 560 and 562 extend slightly beyond the edges of channel 566 and has a depending S-shaped lip formed thereon to provide a mounting surface for a pusher element 559.

Pusher element 559 is essentially in the shape of a cross and is adapted to move longitudinally in gap 564. Pusher element 559 is biased by a flat coil spring that provides a uniform force throughout its effective length, such as the spring known as a "Hunter" type. This spring is located in gap 564, as illustrated by the springs 270–272 in FIG. 37. With reference to FIGS. 18 and 19, it may be seen that one end of the spring is coiled into a roll 745 located in a chamfer 746 in pusher element 559. The other end of the spring is fixedly connected to the cabinet. Thus, the pusher element is always engaging the articles in a tray with a constant force that pushes the articles to the rear of the tray and also serves to actuate the tray when unlatched.

Trays 551 are normally latched toward the front of machine 525 by suitable latching means. In the illustration of FIG. 2, simple overhead latching hooks 555 to engage front wall 558 are illustrated, although it should be recognized that this is merely one form of latching that might be utilized. Another more sophisticated latching arrangement is also disclosed herein (FIGS. 11–14).

Each of the movable trays 551 contains articles to be vended, such as packs of cigarettes 557. Cigarette packs 557 are urged toward the back of trays 551 by pusher elements 559.

When a customer makes a selection of a particular article, the tray in which the selected article resides is unlatched so that it may move the rearmost article in the tray into the vend area 563 (FIGS. 2 and 27). An elevator mechanism 565, which is described in more detail hereinafter, rises to remove the last article in the tray and cause it to be ejected into the dispensing area 547 at the top of vending machine 525. A reset mechanism associated with elevator 565 mechanically cams the rearwardly extending tray 551 towards the front of the machine to locate it in a latch position and prepare the machine for subsequent vend cycles.

FIG. 3 illustrates the circuitry utilized in the vender 525. Electrical energy is supplied to the circuit from a plug 567. A main fuse 569 protects the circuit from overload or surge conditions. A fluorescent lamp 571 is connected directly across the circuit to provide lighting effects for the display panel on the vender 525. A ballast 573 is connected in series with the fluorescent lamp to provide the conventional smoothing effect, while a starter 575 is connected across lamp 571.

The electrical energy provided by plug 567 is conveyed to the major portion of the circuit by a transformer 577, which has a primary winding 579 in parallel with the fluorescent light 571 and a secondary winding 581 which serves as a source of energy for the operating functions of the circuit.

When coins are deposited by a customer, switches 583, 585, 587, 589, and 591 are actuated, the number of switches closed depending upon the coins deposited (i.e., one switch closed by a nickel, two by a dime, five by a quarter). Closure of the coin switches causes a credit add solenoid 593 to be energized in steps according to the number of switches closed. Repetitive energization of credit add solenoid 593 produces stepwise action of the stepping switch arrangement 595. A switch 597 is adapted to be opened during step energizations by solenoid 593 to prevent arcing at the contacts.

When the stepping switch has been rotated a number of steps equal to those required to bring the stepper to a contact representative of the price of an article to be vended, a credit solenoid such as 599, 601, 603, or 605 is energized. Two of the credit solenoids, such as 599 and 601, relate to a single shelf or drawer, while the other credit solenoids 603 and 605 relate to a separate shelf or drawer, and any additional solenoids would also relate to separate shelves or drawers. The credit levels at which the solenoids are actuated are set by means of pricing boards 607 and 609 and pricing tabs 611.

The effect of energization of a credit solenoid may be observed in FIGS. 4 and 5. Credit solenoids, such as credit solenoids 599 and 601, are mounted on a vertical auxiliary sidewall 613. Auxiliary sidewall 613 is spaced from a main sidewall 615 surrounding the operating portions of the vending machine. Armatures 617 and 619 of solenoids 599 and 601, respectively, reciprocate in a horizontal plane at right angles to the auxiliary sidewall 613 and main sidewall 615. Armature 617 is securely connected to a blocking lever 621 by an appropriate linkage 623. Similarly, armature 619 is secure-

ly connected to a blocking lever 625 by an appropriate linkage 627. Linkage 623 is connected to an opening 629 in a tab 631 integrally formed with blocking lever 621. Similarly, linkage 627 is securely fixed in an opening 633 on tab 635 integrally formed with blocking lever 625.

Blocking levers 621 and 625 are mounted on pivot members 638 and 637, respectively, which are pivotally supported on a central pivot axis 639. Blocking levers 621 and 625 are biased toward each other by a spring 641. Linkages 623 and 627 connecting armatures 617 and 619 with blocking levers 621 and 625, respectively, pass through appropriate openings in a channel member 643. Ends 645 and 647 of blocking levers 621 and 625, respectively, also pass through appropriate slots in a bracket 643.

When credit solenoids 599 and 601 are not energized, blocking levers 621 and 625 are in the positions illustrated in FIG. 5, credit lockout levers 649 and 651 are prevented from rotating. Each credit lockout lever is associated with a separate pricing level. Thus, credit lockout lever 649 is associated with the credit level represented by credit solenoid 599, and credit lockout lever 651 is associated with the credit level represented by credit solenoid 601.

When a customer attempts to make a selection of an article to be vended, a sliding segment in the price level chosen is driven against the appropriate credit lockout lever. In the case of credit lockout lever 649, a sliding segment 653 is forced against a pin 655 thereon to rotate credit lockout lever 649 about a pivot 657. If the credit solenoid 599 is not energized, blocking lever 621 prevents credit lockout lever 649 from passing a certain point. The point at which credit lockout lever 649 is blocked is such that the customer cannot make a selection due to a locking of sliding segment 653 by credit lockout lever 649.

If credit solenoid 599 is energized, armature 617 is drawn into the core of solenoid 599 (i.e., to the right in FIGS. 4 and 5) and blocking lever 621 is pivoted about pivot point 637 to free credit lockout lever 649 for rotation. As credit lockout lever 649 is freed for rotation, sliding segment 653 will be permitted to move far enough in a longitudinal direction to permit the customer to make his selection.

Rotation of credit lockout lever 649 brings it into abutment with a roll 659 on the end of an arm 661 of a centrally pivoted lever 663. Lever 663 is pivoted at a pivot point 665 and has a second arm 667 extending in the opposite direction from arm 661. As lever 663 is rotated, it opens a switch 664 in series with a coin return solenoid 666 to prevent return of deposited money upon a selection being made. If a selection has not been made, the customer may have his deposited money returned by manually actuating switches 951 and 953 to complete circuits to a stepper reset solenoid 917 and the coin return solenoid 666. Energization of stepper reset solenoid 917 results in actuation of switches 916 and 918 to reset the stepper switch 595.

Arm 667 is also utilized to provide a lockout function between the various shelves or drawers. One example of a vertical lockout arrangement that could be utilized is the use of a vertical locking rod arrangement that would utilize a rod such as 669 which would be actuated by the end of arm 667 as lever 663 is rotated. Another method by which such a lockout may be achieved is to utilize a series of sliding segments 728 (FIG. 10) which may be separated only far enough to permit the passage of a single arm 667. Thus, an attempt to rotate the pivoted lever 663 at some other level having the same pricing arrangement (so that the credit solenoid at the second level would be energized) would be precluded from being actuated if one lever 663 has already been actuated. Various other types of vertical lockout arrangements could be utilized, but the sliding segment approach has the advantage that it is already incorporated into the system as a horizontal lockout arrangement, as discussed hereinafter.

Selections made by a customer are realized by actuating selector buttons such as 539 (FIG. 6). A shaft 670 extends from selector button 539 through wall 671 of the vending machine to an enlarged end 672. A spring 673 extends between a flange 674 fixed to shaft 670 adjacent wall 671 and a stop 676 slidably mounted on shaft 670. Stop 676 abuts a vertically extending member 680 which is located on an actuator plate 677 and has an opening to permit passage of shaft 670 therethrough. Enlarged end 672 of shaft 670 is adapted to pass through an opening (not shown) in a vertical riser extending from plate 677 to sliding actuator shelf 678.

As the selector button 539 is depressed, a force is applied through spring 673 to drive an actuating mechanism 675 which comprises actuator plate 677, a rotatable sliding actuator 679, and an actuator bar 681. Spring 673 is arranged on the actuator plate 677 in such a manner as to provide an override in the event that the rotatable sliding actuator 679 is jammed to forcefully by the operator of is continually pushed by the operator when it is not free to travel the full extent of its natural stroke (e.g., insufficient credit has been established). In other words, the force provided by the spring when a selector button is actuated is sufficiently great to mobilize the actuator mechanism when conditions are appropriate for doing so. However, if for some reason the actuator mechanism is not free to move through its normal stroke (such as an insufficient credit), the spring will absorb the additional force supplied by the customer so that the actuator mechanism, primarily the rotatable sliding actuator 679, is not jammed, as would be the case if straight mechanical linkage were involved.

The rotatable sliding actuator 679 is shown in greater detail in FIGS. 7 and 8. From these drawings it may be seen that the rotatable sliding actuator 679 comprises a central cylindrical body 683 in which a hexagonally shaped opening 685 is formed to receive an appropriate tool to rotate the actuator 679. A pair of arms 687 and 689 are formed on the central cylindrical body 683 and project therefrom at two different vertical levels and are angularly separated by ninety degrees.

V-shaped projections 691 formed by sides 693 and 695 formed at an angle to the longitudinal axis of the arms 687 and 689 are located at the free ends of the arms. The vertical distance between arms 687 and 689 is the vertical displacement between parallel horizontal series of sliding elements. The ninety degree angular displacement between arms 687 and 689 permits the actuator 679 to be rotated by placing an appropriate tool in the opening 685 and thus have one or the other of arms 687 or 689 adapted to engage the sliding elements.

The relationship of the rotatable sliding actuator 679 to the sliding segments is best seen in FIGS. 6, 9, and 9A. In FIG. 6, it may be seen that a series of sliding segments 653 are located in a horizontal plane across the width of a drawer. Each of the segments 653 has the corners 697 and 699 cut at an angle to the longitudinal axis thereof, so that as adjacent segments are placed together a V-shaped notch 701 is formed. The V-shaped notches 701 are adapted to mate with the V-shaped projections 691 on the sliding actuator arms 687 and 689.

Although not shown in the drawings, sliding segments 653 are located in a channel member that restricts their movement to a longitudinally reciprocal type of motion. The sliding segments 653 are located in the channel in abutting relationship, but with enough room in the channel to permit any two of the segments to be spaced by the width of one of the sliding actuator arms 687 or 689. When a sliding actuator arm 687 or 689 is inserted between two adjacent sliding segments, these segments expand to fill the channel and prevent the placing of another sliding actuator arm between any other pair of sliding segments. Therefore, when one of the sliding actuator arms has been moved to engage the sliding segments and force an adjacent pair of such segments apart, the remainder of the sliding actuator arms are locked out and cannot be forced between any adjacent pair of sliding segments. Thus, depression of a selector button 671 by a customer will cause a sliding actuator arm 687 or 689 to be forced between a pair of adjacent sliding segments (assuming that appropriate credit has been recorded for selection of an article at that price), but any attempt by the customer to make an additional selection will

be blocked because the first playing actuator arm will have taken up all of the "slack" or unoccupied space in the horizontal direction in the channel member.

This operation of the sliding segment lockouts may best be observed in FIGS. 9 and 9A. These figures schematically illustrate the operation of the lockout arrangement. In FIG. 9A it may be seen that the sliding segments **653** are normally biased to the left by a bias spring **703** (purely schematic). In actuality, another bias spring would also be located at the other end to permit limited expansion in both directions, but the schematic arrangement shown is sufficient for illustrative purposes. In the rest position, the leftmost sliding segment abuts the stationary stop **705**. This positioning of the sliding segments **653** leaves an opening **707** at the extreme right-hand edge that is just slightly wider than the width of the arms on the sliding actuators **679**. Also, in this position the V-shaped projections on the arms of the sliding actuators are positioned directly opposite the V-shaped notches formed by the angled corner edges of the sliding segments **653**.

When a particular sliding segment **653**, such as that designated **709**, is pressed forward by depression of a corresponding selector button **539**, the sliding segments are forced apart against the biasing force **703**. Since all of the segments to the left of the sliding actuator being pressed forward have no slack between, all of the movement occurs by having sliding segments moved toward the right. This is purely an exemplary type of operation, since the V-shaped form of the projections on the sliding actuary arms and the V-shaped notches formed by adjacent angle corners of sliding segments permit a great deal of latitude in the placement of the V-shaped projections with respect to the V-shaped notches. In any event, in this particular example, expansion of the sliding segments to the right of **709** against the force **703** causes the sliding segment **653** on the extreme right-hand edge to abut a stationary stop **711**. Since the space **707** was only slightly greater than that needed for arm **709** to pass between adjacent segments, no additional sliding actuator arms may pass between sliding segments as long as arm **709** is in the position shown in FIG. **9A**, and thus the additional sliding actuators, and the selections represented thereby, are locked out.

Shelf **678** on which rotatable sliding actuator **679** is located is fixedly adjoined with the actuator bar **681**. Actuator bar **681** extends through an appropriate opening in a mounting bracket **713** that serves to guide the movement of actuator bar **681**. In the inactive or quiescent state illustrated, a shoulder **715** on actuator bar **681** engages a projecting arm **717** on a safety latch **719**.

The relationship of the sliding segments **653** to the price and credit lockout arrangement discussed in connection with FIGS. **4** and **5** may be observed with reference to FIG. **10**. In this figure two horizontal series of sliding segments may be observed, an upper series **721** and a lower series **723**. The last sliding segment (to the right rear in the FIG. **10** orientation) in both the **721** series and the **723** series of sliding segments is adapted to drivingly engage a separate credit lockout lever. As previously indicated, the last sliding segment **653** in the series of segments **721** engages a pin **655** depending from the credit lockout lever **649**. The last segment **653** in the series of segments **723** engages a pin **727** projecting upwardly from credit lockout arm **651**. When no credit has been recorded in the machine credit lockout levers **649** and **651** are normally biased to a position parallel to the cabinet wall **615** (FIG. **4**), and an attempt by a customer to make a selection will drive the sliding segments to the right and hence pivot the credit lockout levers **649** and **651** against the biasing force to the position illustrated in FIG. **10**. In the FIG. **10** position, blocking levers **621** and **625** prevent sufficient rotation of credit lockout levers **649** and **651**, respectively, to permit initiation of a vending cycle.

Utilization of the two series of credit lockout sliding segments **653**, and the associated credit lockout levers **651** and **649**, permit the operator to make a selection between two price levels for each tray of articles. The selection is made by rotating the rotatable sliding actuators **679** in order to have the appropriate arm adjacent the selected price level. The credit solenoids **599** and **601** will, of course, be energized by a signal from the stepping actuator that corresponds to the deposit of a credit equal to the selected price level for the particular series of sliding segments and associated lockout elements. As previously indicated, rotation of one of the credit lockout levers **649** or **651** past its associated blocking lever causes it to engage the roll **659** on the centrally pivoted lever **663**, and, as previously indicated, centrally pivoted lever **663** is utilized to provide a vertical lockout between vertical shelf levels in the apparatus. There are many ways of performing such a lockout function, and as previously indicated, in a preferred structure the sliding segment approach utilized for individual selection lockout on a horizontal tray is utilized to achieve the vertical lockout function. Another series of sliding segments **728** are located in a vertically positioned channel member **730**. A sliding actuator **729** having a V-shaped engaging portion **731** is positioned on end **733** of lever **663**. A stop plate (not shown) is placed at the upper end of the channel to limit the area in which sliding segments **728** may expand.

Due to the force of gravity, the sliding segments are normally positioned in their lowermost state. This leaves a space at the top of the series that is approximately the width of the sliding actuator **729**. When a selection is made that corresponds to the particular lever **663**, sliding actuator **729** is forced between two adjacent sliding segments **728**. If a selection is made at the same price or another shelf, the sliding actuator **729** of that pivoted lever **663** will be precluded from entering adjacent sliding segments due to the fact that there is no more room in which the segments may expand. Thus, the associated credit lockout lever (such as **649** or **651**) would abut against the roll **659** and would not be able to move beyond the position in which they are normally held by blocking levers **621** and **625**, due to the fact that lever **663** would not be rotatable.

In FIG. **2** it may be seen that as the article to be vended, assumed to be a pack of cigarettes for this discussion, is pushed toward the back of tray **551** by pusher **559** it engages end portions **747** which are sufficiently wide to prevent a pack of cigarettes from passing beyond the end of the tray. The end portions **747** are extended upwardly for the height of the tray **551**. At the top of the extending portions **747**, a horizontally disposed, generally U-shaped top member **749** is placed at right angles to extending portions **747**. The length of the legs of the U is such that only one package can pass between the bight of the U and the vertically extending portions **747**. Thus, the top member **749** serves the function of engaging any cigarette packages that are not placed in the bottom of the tray and forcing them into the downward position as they are moved towards the back of the tray. Also, the bight of the U-shaped top member **749** serves to prevent the next to last package from being upwardly projected when the last package is removed during the vend cycle.

Trays **551** are normally latched in the forward, unactuated, or rest position by the latching arrangement illustrated in FIGS. **11–14**. In these figures, it may be seen that the tray latching arrangement utilized three primary latching levers, a standby latch lever **751**, a safety latch lever **719**, and an actuator latch lever **753**. Standby latch lever **751** and safety latch lever **719** have essentially the same construction, which includes a triangularly shaped hooking head **755** of standby latch lever **751** and a corresponding triangularly shaped hooking head **757** on safety latch lever **719**. A latching surface **759** is formed on one end of the triangularly shaped hooking head **755** of standby latch lever **751**, and a similar latching surface **761** is formed on head **757** of safety latch lever **719**. Standby latch lever **751** and safety latch lever **719** are commonly pivoted on a pivot **763**. Standby latch lever **751** and safety latch lever **719** are biased toward each other by a spring **765**. A projecting arm portion **767** is formed on standby latch lever **751** and is positioned adjacent to and essentially parallel to arm **717** on safety latch lever **719**.

As shown in the FIG. 11 view, latching surface 759 on standby latch lever 751 normally engages a stud 769 depending from a tray 551. The tray 551 is not illustrated in these views, and a constant force spring 561 is schematically illustrated as being connected directly to stud 769 to illustrate the biasing force applied to the stud. This biasing force, of course, maintains stud 769 in forcible engagement with the latching surface 759 in the normal condition illustrated in FIG. 11.

Actuator bar 681 carries a stud 771 that engages arm 717 of safety latch lever 219 in the unactuated or standby condition illustrated in FIG. 11. A spring 773 biases actuator bar 681 to the position shown in FIG. 11. Since the strength of spring 773 is considerably greater than that of spring 765, safety latch lever 719 is held from engagement with stud 769 as a result of the engagement between stud 771 and arm 717.

A shoulder 775 is formed on actuator bar 681 in such a position as to engage arm 767 of standby latch lever 751 when actuator bar 681 is moved toward an actuated position. A projecting ear 777 is formed on the end of actuator bar 681 at the same end at which stud 771 is located, but on the opposite side therefrom.

Actuator latch lever 753 is generally U-shaped and is pivotally mounted on pivot 779 at the bight thereof. A leg 781 of U-shaped actuator lever 753 has a triangularly shaped head 783 formed thereon, which includes a latching surface 785. Latching surface 785 is adapted to engage ear 777 on actuator bar 681. The other leg 787 of actuator latch lever 753 has a projecting pin 789 on the end thereof which is adapted to engage stud 769.

A spring 791 biases actuator latch lever 753 to rotate in a counterclockwise direction to promote engagement between latching surface 785 and ear 777. In the normal standby or unactuated position illustrated in FIG. 11, the engagement between extending pin 789 and stud 769 rotates actuator latch lever 753 against the force of bias spring 791 to bring latching surface 785 into engagement with ear 777 on actuator bar 681.

Assuming that the proper coins have been deposited to yield a total credit equal to the price of the article to be selected, actuator bar 681 may be actuated by a customer making the selection. As the customer makes the selection, actuator bar 681 will be urged toward the latch levers 751, 719, and 753, against the force of bias spring 773.

As actuator bar 681 is actuated, stud 771 is removed from engagement with arm 717 and safety latch lever 719 is freed for rotation. However, the hooking head 757 of lever 719 bears against stud 769 to prevent safety latch lever 719 from rotating to a latched position.

Continued movement of actuator bar 681 results in shoulder 775 on actuator bar 681 engaging arm 767 on the standby latch lever 751. Movement of actuator bar 681 to the position shown in FIG. 12 results in lever 751 being rotated clockwise to release stud 769 for movement under the force of bias spring 561. Movement of stud 769 permits safety latch lever 719 to rotate under the force of spring 765 to the latching position shown in FIG. 12. Also, movement of stud 769 permits actuator lever 753 to rotate under the force of spring 791 to move latch surface 785 into position to engage ear 777 on actuator bar 681.

When the customer has finished making his choice and releases the selector tab, the actuator bar begins its return travel toward the standby or rest position. However, since actuator latch lever 753 has now been rotated to the position shown in FIG. 12, latching surface 785 on lever 753 engages ear 777 on actuator bar 681 to latch the actuator bar in the position shown in FIG. 13. Return of actuator bar 681 to the position shown in FIG. 13 permits standby latch lever 751 to move under the force of bias spring 765 to be positioned in the latching position shown in FIG. 13.

After a vend cycle has been completed, the tray from which the article is dispensed, along with the attached stud 769, is returned toward the front of the vending machine cabinet. As stud 769 approaches a latching position, it contacts side 793 of the triangular head 755 of standby latch lever 751. Side 793 acts as a ramp cam by which standby latch lever 751 is cammed out of the path of a returning stud 769. Similarly, safety latch lever 719 has a ramp cam side 795, upon which stud 769 bears to cam safety latch lever 719 out of the path of stud 769. Of course, the bias provided by spring 765 causes both standby latch lever 751 and safety latch lever 719 to return to the latching position shown in FIG. 14 after the stud has passed.

Return motion of stud 769 also brings the stud into engagement with pin 789 on actuator latch lever 753 to rotate lever 753 in a clockwise direction to disengage latch surface 785 on the latch from ear 777 on the actuator bar. After latch surface 785 is disengaged from ear 777, actuator bar 681 continues its travel to the reset or standby position. During this travel of actuator bar 681, stud 771 thereon engages arm 717 of safety latch lever 719 to rotate the lever 719 in a counterclockwise direction. Counterclockwise rotation of safety latch lever 719 causes latch surface 761 to be disengaged from the stud 769, so that stud 769 moves to the normal latching position adjacent latching surface 759 of standby latch lever 751 under the bias of spring 561. Return of actuator bar 681 to the unactuated position releases the interlock preventing a customer from making any other selections, and the latching arrangement is in position for a customer to make another selection.

In many cases, a particular brand or type of article is much preferred over another type or brand. In such a case, the preferred brand will be dispensed many more times than a nonpreferred brand, so that a tray holding the preferred brand of articles will be emptied prior to the others and the machine will have to be serviced merely to keep that brand available to the customers. It is possible to fill another tray with the favored brand, but experience has shown that one tray repeatedly will be emptied prior to the other, so that the articles in the second tray tend to become stale. To avoid this problem, an arrangement has been provided for alternate dispensing from adjacent trays so that both trays will be emptied at a uniform rate and the number of articles of a particular brand that are available will be greatly increased.

This alternating latch mechanism is illustrated in FIGS. 15, 16, and 17. Two adjacent trays 551 have been identified by the numerals 551*a* aand 555*b* to distinguish then for purposes of this discussion. Tray 551*a* has a stud 797 extending from the bottom thereof, and tray 551*b* has a corresponding stud 799. A slide actuator plate 801 is mounted on the shelf below trays 551*a* and 551*b* and is adapted for motion transverse to the longitudinal axis of the trays. Notches 803 and 805 are formed in the ends of slide 801 and are adapted to engage mounting pins 807 and 809, respectively. The interaction of pins 807 and 809 with the notches 803 and 805 limit the extent to which slide 801 can move in either direction and also prevent slide 801 from rotating. A latch member 811 is located on slide 801 in the area between 551*a* and 551*b*. Latch member 811 is adapted to engage slots 813 and 815 located in trays 551*a* and 551*b*, respectively. Ramps 817 and 819 are formed on the ends of slide 801 in a position to engage studs 797 and 799, respectively. Latches 821 and 823 for holding latching trays 551*a* and 551*b*, respectively, in an unactuated position are illustrated. These latching devices 821 and 823 are utilized in this description merely for purposes of illustration, and the preferred latching arrangement is that illustrated and discussed in connection with FIGS. 11–14.

In operation, the latch 811 is moved to enter slot 813 or 815 upon the return of a tray. As illustrated in FIG. 15, upon a return stroke the trays 551*a* and 551*b* are driven to an overshoot position, such as that occupied by tray 551*a* in FIG. 15, which is beyond the normal latching position, which is that in which tray 551*b* is illustrated in FIG. 15. As tray 551*a* is returned to the overshoot position, stud 797 engages ramp 817 on slide 801 to move the slide 801 to the left (FIG. 15 orientation) and cause latch 811 to move into slot 813. Tray 551*a* then returns to the latch position under the force of the bias spring applied thereto to engage latch 821 and be posi-

tioned in the normal latching position in readiness for another customer selection. In this position, an end 825 of slot 813 engages the latch 811.

A treadle arrangement (not shown) shown) is attached to both latches 821 and 823, so that any attempt to make a selection from either tray 551*a* or tray 551*b* results in simultaneous unlatching of both trays. Thus, after 551*a* returns to the latching position, a selection of the articles in either tray 551*a* or tray 551*b* results in the unlatching of both latches 821 and 823, but latch 811 prevents tray 551*a* from moving beyond the latch position, so that only tray 551*b* is utilized for dispensing the article. Upon return of tray 551*b* the slide 801 will be cammed to the right (FIG. 15 orientation) by engagement of stud 799 with ramp 819. Then, when tray 551*b* is in the normally latched position, latch 811 will engage end 827 of slot 815. Therefore, any subsequent selection of an article from either tray 551*a* or tray 551*b* will result in dispensing of an article from tray 551*a*. In this fashion, alternate dispensing from trays 551*a* and 551*b* is achieved until all of the articles are removed from both trays.

When all of the articles in a tray have been vended, it is desired to inactivate that tray and prevent a customer's selection thereof to be ineffective. Since pin 789 on actuator latch lever 753 is positioned to engage stud 769 and rotate lever 753 to a position such that it cannot engage actuator bar 681 when stud 769 is in the normally latched position, a sold-out lockout feature may be achieved by holding the tray in the normally latched position when there are no more articles to be dispensed from the tray. Such an arrangement is illustrated in FIGS. 18 and 19. In this arrangement, a freely movable locking link 829 is both supported and biased by a spring 831. Spring 831 engages a pin 833 on link 829, while link 829 carries a stud 835 that limits the motion of link 829. An end 837 of link 829 fits through opening 839 in the bottom of shelf 841. Stud 835 extends beyond the limits of opening 839 to limit the upward motion of link 829 to the position illustrated in FIG. 18.

In operation, this sold-out lockout feature is based upon the fact that in normal operation the slot 564 in the bottom of a tray 551 is covered by a spring 561. In FIGS. 18 and 19 a pusher member 559 with the roll 745 of spring 561 located therein is illustrated. FIG. 19 depicts the situation wherein there is one article yet to be vended. In this situation, the link 829 is maintained in the depressed condition illustrated due to the presence of the spring roll 745 in slot 564 of the tray 551. However, as illustrated in FIG. 18, when the last article is vended the pusher element moves sufficiently to permit the head 837 of link 829 to rise through opening 839 and groove 741 in the tray. Stud 835 limits the upward motion of link 829 to that illustrated in FIG. 18. In the position shown in FIG. 18, link 829 is adapted to engage an appropriate projection (not shown) on tray 551 to hold trays 551 in the latched position after it has been returned thereto by a reset mechanism.

As a tray is released and moves back toward a vend position, it energizes a switch 843 (FIG. 3) which closes a circuit to normally closed contacts 845 and 847 to energize a motor 849. Energization of motor 849 results in driving of elevator carriage 565 in an upward direction. At the same time as it closes a circuit to the motor, switch 843 opens the circuit to normally open contacts 851 and 853 and a reversing switch, so that elevator 565 cannot be driven back down until tray 551 is reset in the latch position.

The elevator mechanism is illustrated in FIGS. 20–27. With reference to FIG. 20, it may be seen that the elevator mechanism 565 is mounted on an endless link chain 855. The lower end of link chain 855 engages a driven sprocket wheel 857, while the upper portion of link chain 855 engages an idler sprocket wheel 859. Referring to FIG. 21, it may be seen that elevator mechanism 565 extends from link chain 855 to a second link chain 861 that is at the opposite side of the vending machine cabinet. Link chain 861 also engages a driven sprocket wheel 863 at the lower end thereof and an idler sprocket wheel 865 at the upper end thereof.

The elevator mechanism 565 is mounted on endless chains 855 by a link chain engagement apparatus 877. Mounting plates 867 are securely bolted to the link chain engagement apparatus 877 and engage the lengths of endless chains 855 and 861 parallel to the lengths on which apparatus 877 is mounted. Mounting plates 867 are secured to the lower portion of elevator mechanism 565 and are secured to a U-shaped channel structure 869 that extends the entire width of the elevator mechanism. A cam member 871 extends outwardly from a pivot mounting 873 located within the channel member 869. A spring 875 is attached to cam member 871 to present a bias force against a downward movement (i.e., clockwise rotation in the FIG. 20 orientation) of cam member 871.

On a mounting structure 879 extending upwardly from the U-shaped channel member 869 and connected to an upwardly extending flange 881 of mounting plates 867 by bolts 883 there is located an article dislodging and dispensing mechanism 885. Each of the article dispensing apparatuses 885 is secured to the U-shaped channel 869 by a U-shaped bracket 887. The article dispensing apparatus 885 comprises a back portion 889 and a bottom portion 891. Bottom portion 891 is essentially a central extending tongue with space on either side to permit the passage of the rear portion of the trays 551. Back portion 889 is essentially a solid member with sidewalls 893 extending forward therefrom to maintain the article in the dispensing apparatus.

Each of the dispensing apparatuses 885 is securely mounted on the bight of the U-shaped bracket 895. The U-shaped brackets 895 are secured to a pivoted lever 897, which is mounted on a pivot 899. A cylindrical rod 901 extends the width of the cabinet and is adjoined to pivoted lever 897. A spring 903 biases the dispensing apparatus to the position illustrated in FIG. 20.

When elevator 565 begins its upward movement, cam member 871 engages a cam wheel 905 to actuate a set of switch contacts generically designated as 907. As may be seen in FIG. 3, actuation of cam wheel 905 results in closing the contacts of switch 909 to energize motor 849 and to open a line to the stepper mechanism 695 and the coin switches 583, 585, 587, 589, and 591. Actuation of roller cam 905 also results in closing of switch 911 to energize coin deposit solenoid 913 and closing of switch 915 to energize credit reset magnet 917.

Continued upward movement of elevator car 565 results in the appropriate dispensing apparatus 885 contacting the article in the release tray when the finger bottom 891 engages the article, indicated schematically as a pack of cigarettes 557, the article falls to the position indicated in the lower portion of FIG. 20. The elevator mechanism 565 continues its upward motion until, toward the top thereof, a stop 921 engages the rod 901 and causes the dispensing apparatus 885 to rotate about its pivot 899. The effect of stop 921 and the rotary motion of dispensing apparatus 885 results in the pack of cigarettes being ejected forward onto a sloping surface 923 and conveyed to the dispensing surface 547.

When elevator mechanism 565 reaches the upward limit of its travel, contacts 845 and 847 are closed, as illustrated in FIG. 3, to energize motor 849 in the opposite direction and cause the elevator to be driven downwardly. At the same time, switch 925 is closed to energize match solenoid 927 to cause a pack of matches to be dispensed.

The overall operation of the vending machine apparatus is best understood by reference to the schematic illustration of FIG. 27. In this Figure, it may be observed that a particular selector button 539A has been depressed to release the schematically illustrated latch 929A from tray 551A. Tray 551A has been propelled to the back of the machine so that the last article on the tray is in the vend area 563. Elevator mechanism 565 is energized to progress upwardly, and the article dispensing apparatus 885 engages the last article on tray 551A. An article dispensing apparatus 885 reaches its topmost position it is cammed forward to eject a pack of cigarettes 557

onto sloping surface 923 to convey the pack of cigarettes to the dispensing area 547. As previously indicated, when the elevator reaches its topmost position in the vending machine cabinet, a motor is reversed to drive the elevator downwardly.

The reversing switch arrangement is illustrated in FIGS. 24, 25, and 26, which illustrates the mechanism at the bottom of the elevator area. Specifically, these figures illustrate the mechanism in the vicinity of one of the driven sprocket wheels, such as 857. As may be seen from FIG. 25, a projecting cylindrical cam arm 931 is located on the link chain 855 for rotation therewith. Cylindrical cam arm 931 is adapted to engage two angularly shaped cam members 933 and 935. The cam members 933 and 935 are connected to a longitudinally reciprocable plate 937. Plate 937 carries a pair of actuating bolts 939 and 941 which are adapted to engage a switch actuator 943. Actuator 943 engages and controls the opening and closing of switch blades 945 and 947. Switch blades 945 and 947 control the energization of a solenoid 949 which controls the opening and closing of motor reversing switch contacts 845 and 847, 851 and 853.

In operation, sprocket wheel 857 will rotate in a clockwise direction (FIG. 25 orientation) during downward movement of the elevator mechanism 565. As sprocket wheel rotates in a clockwise direction, the cam arm 931 will engage cam member 935 to move slide 937 to the position indicated in FIGS. 24 and 25, which results in an opening of switch blades 945 and 947. Under these conditions, the motor-reversing switch contacts 845 and 847 revert to their normally closed position.

When the elevator mechanism 565 is driven in an upward direction, cam arm 931 moves past cam member 935 and engages cam member 933 to push the plate 937 to the right in the FIG. 25 orientation. As plate 937 is moved to the right, actuating bolt 941 is removed from engagement with switch actuator 943 and actuator bolt 939 is brought into engagement with switch actuator 943 to produce a closing of switch contacts 945 and 947. Closing of switch contact 945 and 947 results in energization of solenoid 949 to close motor reversing switch contacts 845 and 847 and to open motor reversing contacts 851 and 853 to energize the motor for downward movement of the elevator mechanism 565. After a tray has been reciprocated to a dispensing position and the article to be vended has been removed therefrom it is necessary that the tray be returned to its original latched position. Also, it is necessary to return the tray beyond its normal latch position to an "overshoot" position in order to ensure that latching will be effected. Further, the movement of the tray to an "overshoot" position is utilized to bring about certain other functions in the apparatus. A resetting mechanism that is particularly appropriate to the apparatus disclosed herein is illustrated in FIGS. 28–30. In FIG. 28, it may be seen that a tray 551 is latched in the normal or standby position by a latch 951. Mounted on tray 551 is a pivoted return lever 953 mounted on a pivot 955. Return lever 953 has a weighted arm 957 and an oppositely extending arm 959. A rounded protuberance 961 is formed on the end of arm 959. Weighted arm 957 causes return lever 953 to be normally pivoted in a counterclockwise direction (FIGS. 28–30 orientation) to have a shoulder 963 thereon engage a stop 965 located on tray 551. Mounted adjacent to tray 551 on a shaft 967 is a reset arm 969. Reset arm 969 has an indentation 971 adapted to mate with the protuberance 961 on pivoted return lever 953. There is a pivoted return lever 953 mounted on each tray and a reset arm 969 mounted adjacent each tray.

A crank arm 973 is located on the end of shaft 967 that carries the reset arms 969 for each of the trays. Crank arm 973 has a cam roller 975 located on the free end thereof. Cam arm 871 on elevator mechanism 565 is adapted to engage cam roller 975 on crank arm 973, as may be seen from FIG. 2.

When a selection has been made, latch 951 releases tray 551 to permit it to move under the bias force applied thereto to the position indicated in FIG. 29. In this position, protuberance 961 on return lever 953 mates with the indentation 971 and reset arm 969. As the elevator moves up, cam arm 871 engages cam roller 975 to rotate cam arm 973 in a counterclockwise direction. As indicated in FIG. 30, the maximum rotation of crank arm 973 before cam roller 975 leaves engagement with cam arm 871 causes reset arm 969 to rotate almost 90°. Rotation of reset arm 969 drives tray back toward the latch position against the bias force applied thereto. After tray 551 is returned a certain distance, the force applied by reset arm 969 to return lever 953 causes return lever 953 to rotate in a clockwise direction against the weight of arm 957. Continued rotation of reset arm 696 rotates return lever 953 to the position indicated in FIG. 30 wherein surface 977 on return lever 953 engages stop 965. In this relationship of elements, the tray 551 is returned to an overshoot position. After cam arm 871 passes cam roller 975, crank arm 973 will return to the position of FIG. 28 and tray 551 will move to the latch position illustrated in FIG. 28.

If a tray has not been unlatched for movement to the actuated position, reset arm 969 will not engage reset lever 953, as the positioning of the elements is such that the location of lever 953 in its rest position puts projection 961 out of engagement with indentation 971 on reset arm 969.

The releasable horizontal tray approach utilized in this system has the advantage of being adaptable to mounting in slidable drawers. Drawers 527, 529, 531, and 533 each have rollers 978 adapted to roll in supports 979, All of the components of the horizontal mechanism are located in the drawers 527, 529, 531 and 533. Each of the trays has a pusher element 559 mounted in the tray and spring biased to bear against the articles in the tray. To load the trays, pushers 559 are hooked to a latch bar 981 by means of right-angle latches 983. As indicated in FIG. 34, latch bar 981 is positioned in slot 985. Latch bar 981 extends across the whole width of the vending machine cabinet, and slots 985 are formed in mounting brackets spaced along the width of the cabinet.

A bracket member 987 interconnects latch bar 981 and a right-angle channel member 989. Right-angle channel members are mounted in the bottom of each drawer and at the top of the cabinet above the topmost drawer. Right-angle channel members 989 are vertically movable and are adapted, when placed in a lowermost position, to seal the space between drawers and interlock the doors by mating with a Z-bracket 991.

Vertically extending cam plates 993 are located along both sides of the cabinets. Cam plates 993 are supported at the top by a linkage arrangement 995 and are normally biased downward by bias springs 997. Extending pins 999 located on cam plates 993 at each drawer or shelf level are adapted to engage the corresponding latch bars.

Each of the drawers 527, 529, 531, and 533 have a cam 1001 located on the side thereof. Cams 1001 have a camming ramp 1003 at the forward end thereof, and an upwardly projecting pin 1005 on the top of cams 1001. Each of the cams 1001 is adapted to enter corresponding openings 1007 in cam plates 993.

When the door to the vending machine cabinet is closed, linkages 995 are positioned to place cam plates 993 in their lowermost position by means of a manually actuatable handle 1009. In this position, pins 999 on cam plates 993 engage latch bars 981 and drive them to their lowermost position, so that right angle channel members 989 are engaged with Z-brackets 991, as illustrated in FIG. 34. The drawers are thus interlocked and the spaces between drawers are sealed. Also, the latch bar 981 at its lowermost position is not engageable by hooks 983 on pushers 559, so pushers 559 are in proper engagement with articles in the trays. Therefore, if an operator neglectfully leaves the pushers hooked on latch bar 981 after filling the trays, this arrangement causes the trays to automatically be released.

When the door to the cabinet is open, bar 1009 is actuated to cause linkages 995 to place cam plates 993 in the uppermost position. When the cam plates are raised, latch bars 981 are raised to their uppermost position, since they are normally

biased in this direction. Thus, an operator may hook pushers **559** on the latch bar to fill the appropriate trays. Also, right-angle channel members **989** are no longer engaging Z-brackets **991** so that any of the drawers may be opened.

When cam plates **993** are in the uppermost position, the relationship between cams **1001** and openings **1007** in cam plates **993** is that illustrated in FIG. **35**. Since it is desired to interlock the various drawers in the cabinet to automatically prevent more than one drawer from being opened at a time to minimize the possibility of the cabinet tipping forward, the interaction between cams **1001** and cam plate **993** is utilized to produce the desired result. As indicated in FIG. **36**, if one of the drawers is opened (drawer **527** as an example), the camming ramp **1003** on cams **1001** causes cam plate **993** to move to the lowered position illustrated. Openings **1007** are wide enough to permit a passage of cams **1001**, but not cams **1001** plus pin **1005**. However, since pins **1001** are at the frontmost part of cams **1001**, cams **1005** will pass through openings **1007** upon initial opening of one drawer. However, when cam plates **993** are in the lowered position, pins **1005** on the drawers not opened will engage the cam plates **993** and prevent these drawers from being opened.

Another embodiment of a machine made in accordance with the present invention is illustrated in FIGS. **37–48** and includes a frame assembly **15**, a tray assembly **70**, a dispensing assembly **170**, a carriage assembly **260**, an actuation assembly **360** and an alternating assembly **430**.

As best shown in FIG. **37**, frame assembly **15** comprises a front panel **17**, side panels **19** and **21**, and a rear panel (not shown). The frame assembly also comprises a sloping bottom plate **23** (FIG. **38**) that terminates outside the frame assembly in a dispensing trough **25** that is accessible to an operator of the machine. A pair of upper side braces **27** and **28** are rigidly attached to side panels **19** and **21**, respectively, and provide a supporting foundation for a rear support bracket **31** and a front support bracket **35**. A pair of corresponding lower side braces (not shown) are secured to side panels **19** and **21** beneath upper side braces **27** and **28**, respectively, and form a supporting foundation for a rear support bracket **33** and a front support bracket **37**. Frame assembly **15** also comprises upper L-shaped members **38–43** rigidly attached to bracket **31** and lower L-shaped members **45–50** rigidly attached to bracket **33**. The upper and lower L-shaped members support the rear portions of the tray assembly in a manner described hereafter.

Tray assembly **70** basically comprises upper trays **72–74** that are supported on bracket **35** and L-shaped members **38–43**, and lower trays **78–80** that are supported on bracket **37** and L-shaped members **45–50**. Each of the trays is identical, and all may be understood from the following description of exemplary tray **78** best shown in FIGS. **38, 41, 42** and **45**.

Tray **78** basically comprises a front end plate **84** and side panels **86, 88** that include rear guard members **90, 92**, respectively. Tray **78** also includes a bottom plate **94** comprising a left side portion **96** and a right side portion **98**. As best shown in FIG. **41**, left side portion **96** includes a horizontal panel **100**, a vertical panel **102**, and a V-shaped panel **104**. Likewise, right side portion **98** includes a horizontal panel **106**, a vertical panel **108**, and a V-shaped panel **110**. As best seen in FIG. **42**, panel **100** has a rear edge **112** and panel **106** has a rear edge **114**. Tray **78** also includes an aperture **116** defined by rear edges **112** and **114**, portions of side panels **86** and **88**, and rear guard members **90** and **92**. As will be explained in more detail hereafter, aperture **116** is sufficiently large to allow the passage of a vendable article therethrough.

Tray **78** also includes a support unit **120** that comprises side members **122, 123** that bear slots **124, 125**, respectively (FIG. **42**). Support unit **120** also includes a top member **126** comprising side members **128, 130** and a center brace **132**. The side members and center brace define an opening **134** that is adapted to receive a portion of the dispensing assembly as described hereafter.

As best shown in FIGS. **38** and **41**, support unit **120** is adapted to receive a cam assembly **138** that includes a brace **140** movably mounted to side members **122, 123** by screw pairs **142, 143** and **145, 146**, respectively, that are extended through slots **124, 125**, respectively. (Cam assembly **138** has been removed from FIG. **42** in order to clarify the drawing.) Cam assembly **138** further includes a cam member **148** that is attached to a lower edge **141** of brace **140**. Cam member **142** is adapted to mate with a vendable article inadvertently raised above its proper position in tray **78**, and to push it into its proper position in contact with the bottom of the tray.

As best shown in FIGS. **43** and **44**, dispensing assembly **170** comprises horizontal support bars **172, 174** and vertical support bars **176, 178** and **180**. In addition, vertical spacer bars **182–187** are rigidly attached between bars **172, 174**. A pair of upper rollers **190** and **192** are attached at either end of bar **172** by brackets **194** and **196**, respectively, and a pair of lower rollers **198** and **200** are attached at either end of bar **174** by brackets **202** and **204**, respectively. As best seen in FIGS. **42** and **43**, rollers **190** and **198** are positioned to roll against a vertical brace **206**, and rollers **192** and **200** are positioned to roll against a vertical brace **206**, and rollers **192** and **200** are positioned to roll against a vertical brace **208**. Dispensing assembly **170** also comprises side rollers **210** and **212** that are adapted to guide the assembly in vertical tracks **214** and **216**, respectively.

As illustrated in FIGS. **43** and **44**, dispensing assembly **170** also includes upper dispensing members **222–224** and lower dispensing members **226–228**. Each of the dispensing members is identical, and all may be understood with reference to the following description of exemplary dispensing member **226**. With reference to FIGS. **38, 43** and **44**, dispensing member **226** comprises a vertical support plate **230**, a sloping trough **232**, and a vertical dispensing plate **234** that are preferably formed from a single sheet of material. In addition, vertical dispensing plate **234** comprises an engagement surface **236** that is used to eject an article located adjacent guard members **90, 92** through aperture **116** and a retaining surface **238** that is used to retain all other vendable articles in tray **78** as the aforementioned article is being ejected.

Dispensing assembly **170** also comprises bottom dispensing members **240–242** that are constructed in a manner identical to dispensing members **222–224** and **226–228**. However, only the sloping trough portions of members **240–242** are functional since no trays are used opposite the members.

Carriage assembly **260** basically comprises upper pusher elements **262–264** and lower pusher elements **266–268**. The carriage assembly also includes upper spring assemblies **270–272** associated with upper pusher elements **262–264**, respectively, and lower spring assemblies **274–276** associated with lower pusher elements **266–268**, respectively. Each of the pusher elements id identical, and all may be understood with reference to the following description of exemplary pusher element **266** best shown in FIGS. **41, 42** and **45**. In this regard, it should be noted that in FIG. **42**, pusher element **266** is shown in the rear portion of tray **78**, whereas in FIG. **45**, pusher element **266** is shown in the front portion thereof. The foregoing change in position of element **266** has been introduced in order to clarify the description, and will be readily understood by those skilled in the art since element **266** assumes both of the positions shown at various times in an operating cycle.

Pusher element **266** comprises a horizontal member **278** and a vertical member **280** that are supported by horizontal braces **282,284** and vertical braces **286,288**, respectively. Pusher element **266** also includes a slide assembly **290** (FIG. **41**) comprising a left upper slide **292**, a right upper slide **294**, a left lower slide **296**, and a right lower slide **298**. The left upper and lower slides are joined together by a vertical member **300**, and the right upper and lower slides are joined together by a vertical member **302**. The slide assembly and adjacent portions of tray **78** are arranged so that pusher element **266** is slidable from the extreme front portion of the tray ad-

jacent front end plate 84 to the extreme rear portion of the tray adjacent guard members 90,92.

Spring assemblies 270–272 and 274–276 are identical, and all may be understood with reference to the following description of lower spring assembly 274. As best seen in FIG. 45, spring assembly 274 comprises a spring 306, and the front edge portion of which is wound in the form of a spool around a rod 308 that is, in turn, mounted in slots 310 and 312 located in vertical braces 286 and 288, respectively. As best shown in FIGS. 41 and 42, a rear end 314 of spring 306 is mounted to a bracket 320 by a nut and bolt combination 318. Bracket 320 is, in turn, mounted to rear support bracket 33 by a screw 322.

Carriage assembly 260 also comprises upper return cam assemblies 326–328 and lower return cam assemblies 330–332. Each of the cam assemblies is identical, and all may be understood with reference to the following description of exemplary assembly 330. As best shown in FIGS. 39, 42, and 43, assembly 330 comprises a ramp member 334, including an upper surface 335, that is securely affixed between bars 178 and 187 of dispensing assembly 170. A lever 336 having a lip 338, a top edge 337, and a rear edge 337′ is pivotally mounted to ramp member 334 by a pivot rod 340, and is urged toward surface 335 by a spring 341.

Carriage assembly 260 also comprises upper return rods 342–344 connected to upper trays 72–74, respectively, and lower return rods 346–348 connected to lower trays 78–80, respectively. As described in more detail later, the return rods and cam assemblies coact together in order to return the trays to their rest (latched) positions as the dispensing assembly is moved in an upward direction.

Actuation assembly 360 comprises upper latch units 362–364 associated with upper trays 72–74, lower latch units 366,367 associated with lower trays 78, 79, and a corresponding lower latch unit (not shown) associated with lower tray 80. Each of the latch units is identical, and all may be understood with reference to the following description of exemplary latch unit 367. With reference to FIGS. 40 and 45, latch unit 367 comprises a lever 370 having a lip 372 adapted to engage a front end plate 373 of tray 79. Lever 370 is controlled by an actuation bar 374 that is connected to the lever by a rod 376 and is pivoted about a rod 378. Actuation bar 374 is selectively operated by a solenoid mechanism (not shown) that is, in turn, connected to a switch (not shown) mounted in front panel 17 and controllable by an operator.

Actuation assembly 360 also includes a motor unit 390 comprising an electric motor 392 that is connected to a speed reducer 393. The speed reducer, in turn, is connected by a shaft 394 mounted through a hole in a separating plate 396 to a lever 398. The separating plate is attached to the top portions of crossbeams 397,397′ that are in turn, attached between side panels 19, 21. One end of lever 398 is connected through a pin 400 to another lever 402, and the opposite end of lever 398 is fitted with a stop fixture 410. Lever 402, in turn, is connected through a pin 404 to a fixture 406 that is securely attached to horizontal support bar 172. Separating plate 396 is also fitted with a stop member 408 that is adapted to mate with stop fixture 410 and thereby prevent movement of levers 398,402 and dispensing assembly 170 beyond a predetermined position.

Alternating assembly 430 embodies apparatus whereby like articles in two adjacent trays may be dispensed alternatively from each tray so that the supply of articles in both trays is exhausted at approximately the same rate. Although alternating assembly 430 is shown between trays 78 and 79 herein, it may be used between any two adjacent trays in the apparatus.

As best shown in FIGS. 45–48, assembly 430 basically comprises a cam 432 having a first edge 434 periodically positioned in the path of tray 79 and a second edge 436 periodically positioned in the path of tray 78. Cam 432 is rigidly connected to a bar 438 that is, in turn, pivotally mounted to a slide 442 by a rod 440. Cam 432 and bar 438 are pivoted about a rod 444 so that slide 442 is free to move back and forth between pairs of positioning members 446,448 and 447,449 and between a slot 452 in tray 78 and a slot 454 in tray 79. When alternating assembly 430 is in the position shown in FIG. 45, slide 442 is entered into slot 454 and is positioned outside slot 452. Thus, tray 78 would be allowed to move in a manner described hereafter, whereas tray 79 would be held in the position shown by the presence of slide 442.

In order to operate the apparatus described, each of the trays is generally filled with vendable articles by manually moving the pusher element associated therewith to the front edge of the tray and inserting the articles from the top. When the machine is serviced, different kinds of articles may be placed in each separate tray, but the articles within any one tray should be alike. Although a variety of articles may be vended by the present apparatus, the embodiment shown herein will be described in connection with the dispensation of cigarette packages.

As each tray is filled with packages, the spring associated therewith biases its corresponding pusher element so that the row of packages in the tray is pushed toward the rear portion thereof (i.e., toward the aperture in the rear end portion of each tray). As the cigarettes in a particular tray are vended, the spring maintains a force on its corresponding pusher element so that the packages remaining in the tray are always urged toward the aperture. For example, as shown in FIG. 38, pusher elements 266 biasing the three cigarette packages 470–472 remaining in tray 78, and pusher element 262 is biasing the relatively larger number of cigarette packages remaining in tray 72. In each case the pusher element biases packages remaining in its tray so that the package at the extreme rear end portion of the tray is always positioned directly over the aperture associated with the tray. It should be noted that the type of spring used herein provides approximately equal force on the pusher element no matter where it is located within its tray. Thus, the force exerted by pusher element 266 on packages 470–472 is approximately equal to the force exerted by pusher element 262 on packages in tray 72.

The smooth movement of cigarette packages toward the rear end positions of the trays is also ensured by the cam assembly connected with the support unit in each tray. As best shown in FIG. 38, each cam assembly should be adjusted according to the size of the cigarette package dispensed from its tray. For example, if king size or extra length cigarette packages, such as those illustrated in tray 78 (FIG. 38), are dispensed, the cam assembly 138 is moved in slots 124, 125 until the lower edge 141 of cam member 148 is positioned just above the top edge of the cigarette packages. When the cam assemblies are positioned in the manner described, a cigarette package that is inadvertently raised above its proper position is forced to a position adjacent the bottom of the tray as the package passes beneath the cam member.

Assuming that cigarette packages have been loaded in the trays and that the cam assemblies have been adjusted in the manner described, the operation of the machine will be described assuming that an operator desires the kind of cigarettes held in tray 78. In order to vend a package of cigarettes from tray 78, the operator would operate a switch corresponding to tray 78 located on front panel 17. Actuation of the switch would, in turn, energize a solenoid circuit (not shown) that would raise latch unit 366 to the position shown in FIG. 38, in order to release tray 78. When the tray is released, pusher element 266, together with spring 306, move the tray from its rest position (i.e., a position directly beneath the position of tray 72 in FIG. 38) to its vend position shown in FIG. 38. As soon as tray 78 is moving toward its vend position, latch unit 366 is lowered to its initial position in preparation for the return of the tray. It should be noted that all other trays in the machine (e.g., tray 72) remain in their rest positions after tray 78 has moved to its vend position.

As best shown in FIGS. 38 and 42, when tray 78 is in its vend position, dispensing member 226 fits partially within the support unit 120 of tray 78 and is arranged so that engagement surface 236 is positioned directly above the front edge of pack 470 (i.e., the edge adjacent pack 471). In addition, it should

be noted that aperture **116** extends beyond L-shaped members **45, 46** so that the area immediately beneath the aperture is open. After tray **78** is in the position shown in FIG. **38**, a circuit is completed by well-known means to motor **392**, and the motor begins to turn in a direction such that lever **402** and dispensing assembly **170** are lowered from their rest positions shown in FIG. **38**. As the dispensing assembly is lowered, engagement surface **236** of dispensing member **226** engages the top of pack **470** and begins to push the pack in a downward direction. As the dispensing assembly continues to be lowered, the retaining surface **238** of dispensing member **226** makes contact with pack **471**, thereby retaining the pack in the tray and preventing its ejection. As shown in FIG. **44** pack **470** is pushed through aperture **116** by dispensing member **226** until the member assumes the discharge position shown in phantom. The pack then extends below the bottom of the tray and is released. After the pack is released, it falls onto the trough portion of bottom dispensing member **240** and is deflected to the rear of the machine. Thereafter, the pack falls onto bottom plate **23** and slides to the front portion of the machine where it is exposed to the operator in dispensing trough **25**. After pack **470** has been ejected and the dispensing assembly has been raised to its initial rest position shown in FIG. **38**, pusher element **266** forces the remaining packs **471, 472** toward the rear end portion of tray **78** so that pack **471** assumes the position above aperture **116** previously occupied by pack **470**.

As dispensing assembly **170** is lowered in order to eject pack **470**, return cam assembly **330** is placed in a position to return tray **78** to its rest position when the dispensing assembly is later moved in an upward direction toward its rest position by motor **392**. As best shown in FIG. **42**, when tray **78** is initially moved to its vend position (shown in FIG. **38**), lip **338** of lever **336** is positioned above pivot rod **340** and in contact with upper surface **335** of ramp member **334**. As the dispensing assembly is lowered, the underside of lever **336** is engaged by rod **340** so that the lever is moved in an upward direction until it eventually assumes the position shown in FIG. **39**. It should also be noted that the lever associated with cam assembly **326** is also raised by its corresponding rod **342** on tray **72**. As the dispensing assembly is lowered from the position shown in FIG. **39** toward its discharge position, toe top edge **337** of lever **336** falls below return rod **346**, and the lever is returned to a position adjacent upper surface **335** by spring **341**. Thereafter, when the dispensing assembly is moved upward from its discharge toward its rest position, the upper surface of lever **336** engages the underside of rod **346** and forces the rod in the direction of arrow A (FIG. **39**), thereby returning tray **78** toward its rest (latched) position. After tray **78** has been returned to its rest position (i.e., has been moved beneath the rear edge of latch unit **366** and into contact with the lip thereof), lever **336** continues to push the tray past its rest position toward the front of the machine for a short distance until rear edge **337'** of lever **336** extends above rod **346**. Thereafter, the return rod is positioned below lever **336**, and is free to return to its rest position. Tray **78** is then held in its rest (latched) position and is ready for another operating cycle.

All of the remaining trays in the illustrated embodiment are operated in an identical manner and may be understood with reference to the foregoing description of the operational mode of tray **78**.

The operation of alternating assembly **430** will now be described in detail. It should be understood that for some vending machine applications, it is desirable to have popular types of articles placed in more than one tray, so that the supply of the articles cannot be easily exhausted. It is also desirable to have the articles vended from their respective trays at approximately the same rate. Alternating assembly **430** provides a means of achieving the foregoing objects by alternatively vending like articles from first one and then another of two adjacent trays, irrespective of the order in which the articles are selected from the trays by operators of the machine.

In order to utilize alternating assembly **430**, which is placed between trays **78** and **79**, vendable articles of like kind would be placed in the two trays (i.e., trays **78** and **79**). In addition, the solenoids operating latch units **366** and **367** would be interconnected so that energization of one would also energize the other. That is, the solenoids would be connected so that both latch units **366** and **367** would be raised to their unlatched positions if either solenoid were energized by an operator.

As shown in FIG. **45**, slide **442** is engaged in slot **454** of tray **79**, thereby holding tray **79** in a secured position and preventing movement of the tray toward its vend position. Tray **78**, on the other hand, is shown in FIG. **45** in its vend position in preparation for the removal of an article therefrom. As previously explained, when the vending operation in connection with tray **78** has been completed and the tray is being returned toward its rest position toward the front of the machine. As the tray is moved past its rest position toward its secured position (i.e., a position corresponding to the position of tray **79** shown in FIG. **45**), front end plate **84** makes contact with edge **436** of cam **432**, thereby moving the cam and bar **438** in a clockwise direction (as viewed in FIG. **45**). When the cam and bar are moved in the manner indicated, slide **442** is removed from slot **454** of tray **79** and is moved into clot **452** of tray **78**. Accordingly, tray **79** is released from its secured position and is advanced to its rest position (i.e., the position in which it is held by lip **372** of latch unit **367**), and tray **78** is thereafter held in its secured position. Accordingly, during the next vending cycle, tray **79** is advanced into its vend position and tray **78** is held in its secured position irrespective of whether the solenoid connected with latch unit **366** or **367** is energized.

After an article has been vended from tray **79** and the tray is advanced beyond its rest toward its secured position, the front end plate of the tray makes contact with edge **434** of cam **432**, thereby returning the cam, bar, and slide to their respective positions shown in FIG. **45**. Thereafter, during the next vending cycle, tray **79** is again held in its secured position and tray **78** is free to move to its vend position.

It should be understood that various modification, changes, and variations may be made in the arrangements, operations, and details of construction of the elements disclosed herein without departing from the spirit and scope of the present invention.

We claim:

1. Article-vending apparatus comprising:

a transport member storing articles to be dispensed and mounted for longitudinal reciprocable motion between a rest position and a vend position;

a vend area, an article to be dispensed from the vending apparatus located at the end of said transport member adjacent said vend area;

actuating means producing movement of said transport member to said vend position to place the article to be dispensed in said vend area;

extracting means for removing the article to be dispensed from said transport member for dispensing thereof; and

reset means for returning said transport member to said rest position.

2. A vending apparatus as claimed in claim **1** wherein said extracting means comprises an elevator mechanism adapted to extract the article to be dispensed from said transport member upon upward movement of said elevator mechanism.

3. An article vending apparatus as claimed in claim **2** wherein:

a plurality of said transport members are located on a horizontal shelf;

a plurality of said horizontal shelves are stacked with adjacent shelves spaced at discrete vertical intervals, said transport members on said shelves aligned along vertical planes; and

said elevator mechanism comprises a single pivoted plate having spaced notches therein to define a series of fingers, each finger adapted to extract articles from said

transport members in an associated vertically aligned column of said transport members.

4. A vending apparatus as claimed in claim 2 wherein said elevator mechanism comprises:

a base member adapted for upward and downward movement;

an article removal and conveying member mounted on said base member and adapted to remove said article from said transport member and to convey said article to a dispensing area; and

drive means for reciprocably driving said base member upward and downward.

5. An article-vending apparatus as claimed in claim 4 wherein:

said base member extends between two link chains, one positioned on either side of the article vending apparatus;

said article removal and conveying member comprises a pivoted plate extending from one side of the article vending apparatus to the other and having spaced notches therein to define a series of fingers, each finger adapted to engage an article in the path thereof;

said article removal and conveying member is spring biased for rotation in a counterclockwise direction; and

said drive means comprises a reversible motor.

6. An article-vending apparatus as claimed in claim 5 and further comprising a stop means adapted to engage said article removal and conveying member at the upper end of its upward movement and cause it to rotate in a clockwise direction to eject an article thereon.

7. An article-vending apparatus as claimed in claim 5 and further comprising a motor reversing switch arrangement comprising:

a pair of stop members located on a reciprocably movable plate;

a switch adapted to be opened and closed in response to movement of said movable plate;

actuating rods placed on said link chain and adapted to engage one or the other of said stop means upon movement along the length thereof; and

an electromagnetic solenoid energized by closure of said switch upon movement of said plate.

8. An article-vending apparatus as claimed in claim 1 wherein a plurality of said transport members are horizontally disposed within a slidable drawer.

9. An article-vending apparatus as claimed in claim 1 wherein said transport member is a tray supported by a frame in the apparatus comprising:

a front wall;

two sidewalls extending rearwardly from said front wall;

a bottom portion extending from each of said sidewalls less than half the distance between said sidewalls to form a groove in the bottom of said tray; and

a backwall portion extending from each of said side walls less than half the distance between said sidewalls to form an opening therebetween.

10. An article-vending apparatus as claimed in claim 9 and further comprising a U-shaped stop member located at the top of said backwall portions and horizontally disposed substantially parallel to the bottom of said trays to prevent upward movement of the article adjacent to the article being vended.

11. An article-vending apparatus as claimed in claim 10 wherein said U-shaped stop member is positioned at an angle to a horizontal plane in order to cam articles in said tray against the bottom of said tray.

12. An article-vending apparatus as claimed in claim 9 wherein said activating means comprises

a pusher element mounted in said groove in the bottom of said tray and adapted to engage the from of the articles stored in said tray; and

a constant force spring attached to the frame and having another portion thereof bear against said pusher element to cause said pusher element to bias the articles toward the rear of said tray and to provide an actuating force to produce movement of said tray.

13. An article vending apparatus as claimed in claim 12 and further comprising:

latch means adapted to normally maintain said tray in said rest position; and

a pivoted selector button adapted upon energization thereof to cause said latch to release said tray to move to said vend position under the force of said spring.

14. An article vending apparatus as claimed in claim 1 wherein said extracting means comprises a vertically movable screen having a removal portion adjacent each transport member to remove an article to be vended upon downward movement of said screen.

15. An article-vending apparatus as claimed in claim 14 wherein said removal portion comprises:

a first surface adapted to engage and eject said article; and

a second surface adapted to retain the next adjacent article in said transport member as said article is being ejected.

16. A cigarette-vending machine having a frame and comprising:

a plurality of horizontally disposed longitudinally reciprocable trays containing cigarette packs;

a pusher element located in each tray and positioned in front of the cigarette packs;

constant force springs, each connected at one end thereof to the frame of the cigarette vending machine, the other ends of said springs being attached to respective ones of said pusher elements;

a plurality of latch means, each of said latch means normally retaining an associated one of said trays in a rest position;

a plurality of pivoted selector buttons, each of said selector buttons adapted to actuate an associated one of said latch means to release a corresponding tray for movement to a vend position;

an elevator mechanism adapted to be driven upwardly to extract an article at the rear of a tray in said vend position, said elevator mechanism having a single actuating bar extending across the width of said cigarette-vending machine and having fingers formed thereon, each finger adapted to extract packages from a vertically aligned series of trays;

reset means associated with said elevator means to return a tray in said vend position to said rest position upon upward movement of said elevator mechanism;

ejecting means engaging said elevator mechanism at the limit of its upward movement to cause a pack of cigarettes thereon to be ejected to a dispensing area; and

means for causing said elevator mechanism to be returned to its lowermost position after ejection therefrom a pack of cigarettes.

17. A cigarette-vending machine as claimed in claim 16 wherein all of the trays on a single level are located in a slidable drawer.

18. An article-vending apparatus as claimed in claim 1, wherein a plurality of said transport members are each mounted for longitudinal reciprocable motion of independent of the other transport members.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,608,777 Dated September 28, 1971

Inventor(s) Albinus G. Bodoh, Owen J. Schwertfeger, Roy A. Johnso

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 15, delete "of" and substitute therefor --or--.

Column 12, line 42, delete "aand" and substitute therefor --and--; and delete "then" and substitute therefor --them--; and
line 64, after "return" insert --stroke--.

Column 13, line 4, delete "shown)" (second appearance).

Column 14, line 72, delete "An" and substitute therefor --As--.

Column 16, line 6, after "tray" insert --551--; and
line 11, delete "696" and substitute therefor --969--.

Column 17, line 17, delete "1001" (second appearance) and substitute therefor --1005--;
line 57, delete "V-shaped" and substitute therefor --U-shaped--.

Column 18, line 8, delete "142" and substitute therefor --148--;
line 21, delete "and rollers 192 and 200 are positioned to roll against a vertical brace 206,"; and
line 52, delete "id" and substitute therefor --is--.

Column 20, line 25, after "266" insert --is--.

Column 21, line 42, delete "toe" and substitute therefor --the--.

Column 22, line 17, after "position" insert --, cam assembly 330 drives the tray a short distance past its rest position--;
line 24, delete "clot" and substitute therefor --slot-- and

ORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,608,777 Dated September 28, 1971

Inventor(s) Albinus G. Bodoh, Owen J. Schwertfeger, Roy A. Johnson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 22, line 40, delete "modification" and substitute therefor --modifications--.

Claim 12, Column 24, line 1, delete "activating" and substitute therefor --actuating--; and

..

Claim 16, Column 24, line 57, after "therefrom" insert --of--.

Claim 18, Column 24, line 64, delete "of".

Signed and sealed this 27th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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