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an invention of;
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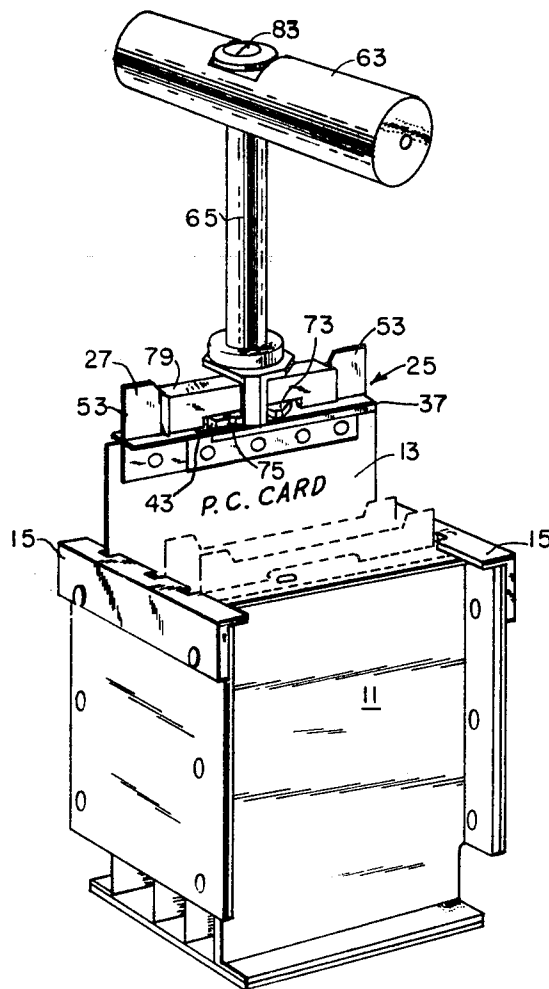
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[54] **DEVICE FOR HANDLING PRINTED CIRCUIT CARDS**
9 Claims, 9 Drawing Figs.

[52] U.S. Cl. **294/15,**
29/278R, 81/3R, 339/17R
 [51] Int. Cl. **B65g 7/12**
 [50] Field of Search **294/1, 16,**
15, 27; 29/270, 278, 283; 81/3

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ABSTRACT: A device for removing printed circuit cards from a container, such as a computer control box, comprising a tool having an end mechanism for engaging an adapter provided on the end of each printed circuit card. The tool firmly interlocks with the card adapter while simultaneously unlatching a spring loaded latch that secures the card in the container. Use of the tool permits removal, handling and replacement of printed circuit cards with the use of one hand.



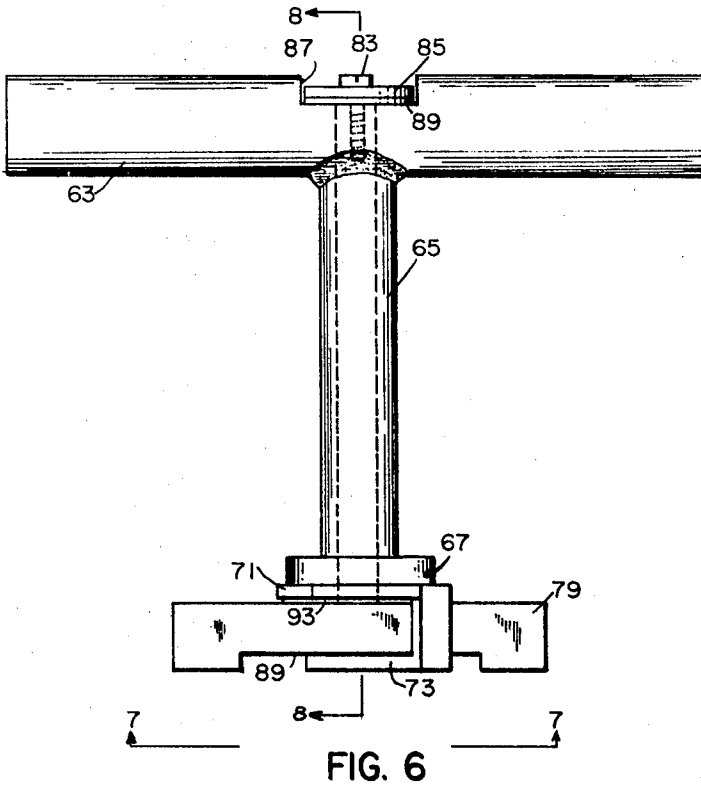


FIG. 6

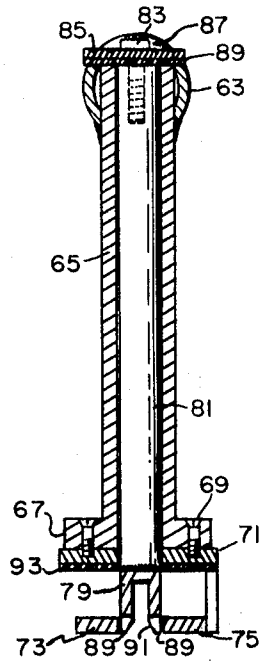


FIG. 8

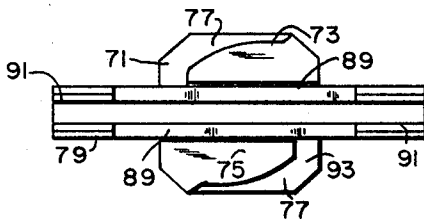


FIG. 7

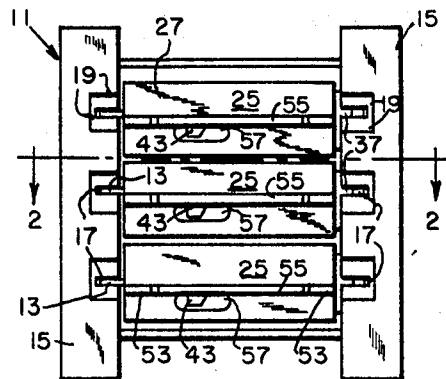


FIG. 1

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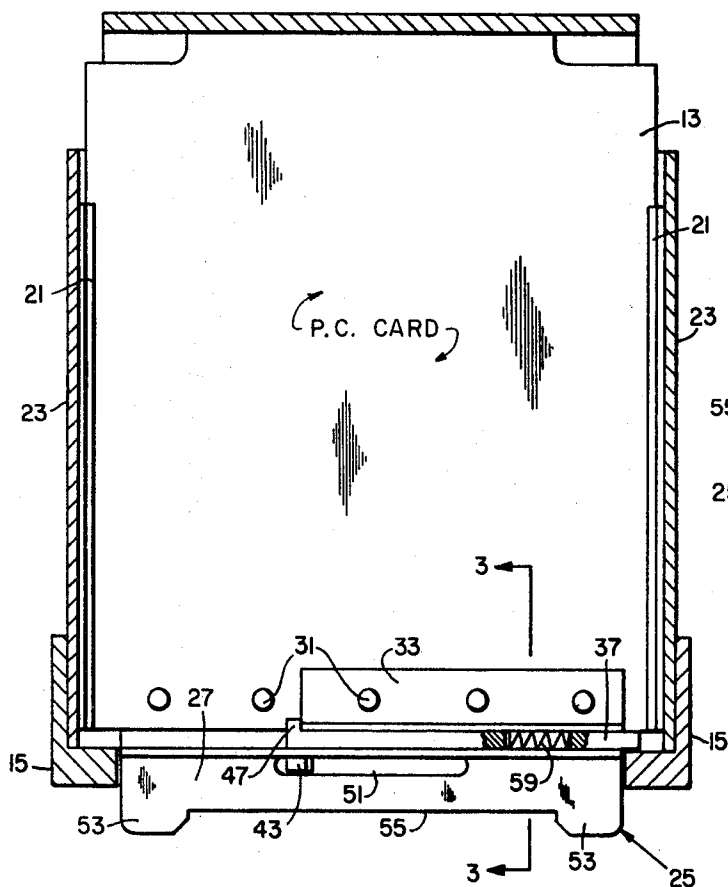


FIG. 2

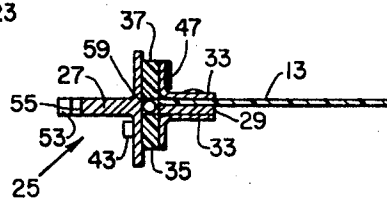


FIG. 3

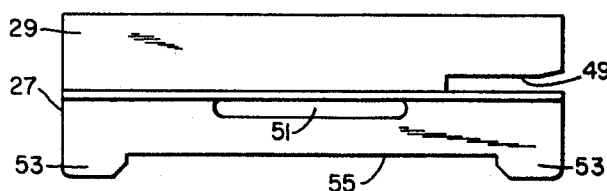


FIG. 4

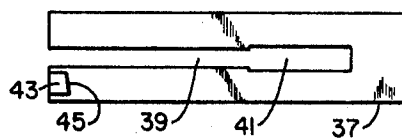


FIG. 5

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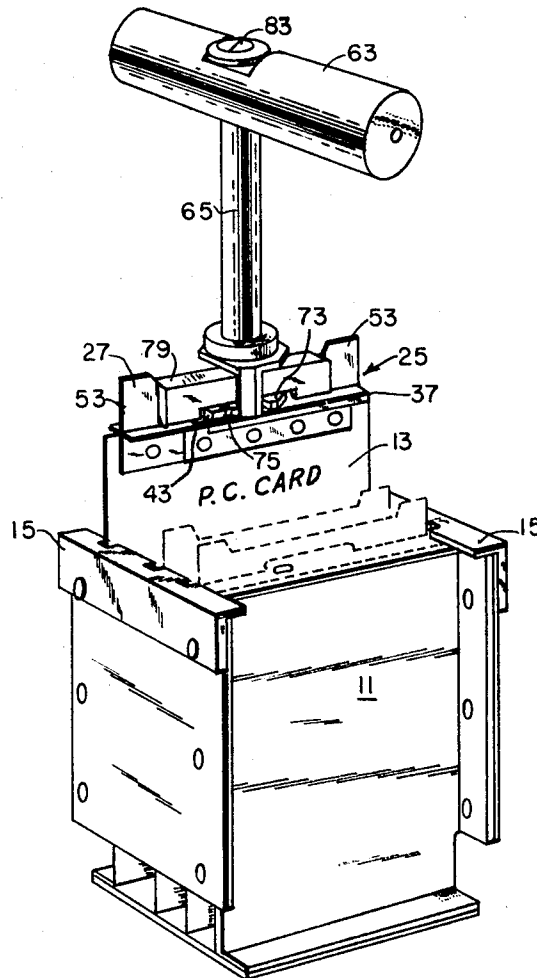


FIG. 9

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DEVICE FOR HANDLING PRINTED CIRCUIT CARDS

ORIGIN OF THE INVENTION

The invention described herein was made in the performance of work under a NASA contract and is subject to the provisions of Section 304 of the National Aeronautics and Space Act of 1958, Public Law 85-568 (72 Stat. 435; 42 U.S.C. 2457).

BACKGROUND OF THE INVENTION

This invention relates generally to handling devices and more particularly to a device for removing printed circuit cards from a container, such as a computer control box, and replacing said cards in the container.

Modern electronic equipment often incorporates cabinet-like containers which hold numerous printed circuit cards arranged one above the other and which slide in and out of the container for purposes of inspection, repair and control operations. The frequent removal and replacement of printed circuit cards in the operation and maintenance of electronic equipment, such as computers, creates a need for a convenient and efficient means for handling of these cards. It is preferable that such a means eliminate any need for touching the cards with the hands to thus avoid contamination and possible damage to the circuitry printed on the surface of the cards. Moreover, for optimum convenience it is desirable that handling of the printed circuit cards require the use of only one hand. It is anticipated that in future space flights of long duration astronauts will be performing various tasks, during extravehicular activity, including the operation and inspection of electronic equipment. Therefore, a convenient and highly reliable device will be required for handling printed circuit cards by astronauts.

SUMMARY OF THE INVENTION

The invention comprises a device for removing printed circuit cards from a container, such as may be incorporated in a computer control unit, and replacing the cards in the container. The cards are typically slid in and out of the container, being guided and held by tracks that frictionally engage the opposite side edges of the cards. According to the invention, the front end of each printed circuit card is provided with an adapter secured to the end of the card. A handling tool for withdrawing the card from the container engages and interlocks with the adapter while simultaneously releasing a latch that secures the card in the container.

The tool comprises two rotatable interlocking elements in the form of cam blades that enter a slot in the card adapter and the rotation of the cam blades is accomplished by rotating a handle provided on the handling tool. To withdraw a printed circuit card from the container the card adapter is engaged by the handling tool and subsequently the handle of the tool is rotated whereupon the two cam blades enter the slot in the adapter. This establishes a firm interlocking between the handling tool and the adapter. After the card is withdrawn it may be replaced in the container by simply pushing the card into its place with the handling tool and rotating the tool handle to its original position thus permitting the latch of the card adapter to move to the latched position and releasing the interlock between the cam lobes and the card adapter.

Accordingly, it is a general object of the present invention to provide a means for conveniently and reliably handling articles with the use of one hand.

A more specific object of the invention is to provide a device for removing printed circuit cards from a container and replacing the cards in the container.

Another object of the invention is to provide a tool for engaging a printed circuit card slideably disposed in a container and simultaneously unlatching a card latch so that the card may be withdrawn from the container and held and replaced in the container by the tool.

Another object of the invention is to provide a device for handling printed circuit cards including moving the cards in and out of a container without the need for touching the cards with the hand.

Another object of the invention is to provide a convenient and highly reliable means for the handling of printed circuit cards by an astronaut during extravehicular activity of a space flight.

These and other objects of the invention will become apparent upon reference to the following specification, attendant claims and drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevational view of a container for printed circuit cards such as may be used in an electronic apparatus;

FIG. 2 is an enlarged cross-sectional view taken along line 2-2 of FIG. 1 showing a printed circuit card positioned in the container;

FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 2 showing an adapter installed on the end of the printed circuit card;

FIG. 4 is a side view of the principal frame element of the card adapter shown in FIGS. 2 and 3;

FIG. 5 is a side view of the latch element of the card adapter;

FIG. 6 is a side elevation view of a handling tool for engaging the card adapter;

FIG. 7 is a view of the lower end of the handling tool taken along line 7-7 of FIG. 6;

FIG. 8 is a cross-sectional view of the handling tool taken along line 8-8 of FIG. 6;

FIG. 9 is a perspective view showing the handling tool interlocked with the card adapter of a printed circuit card with the card partially withdrawn from its container.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, therein is shown a front elevational view of a container 11 that contains in drawerlike fashion a plurality of vertically aligned printed circuit cards 13. The container 11 may represent a component part of an electronic apparatus such as a control unit of a computer system. Corner frame members 15 of the container 11 have vertically spaced slots 17 therein that receive the opposite side edges of the respective printed circuit cards 13. Slanted guide surfaces 19 guide the printed circuit cards into the slots 17. As shown in FIG. 2, guide tracks 21 are attached to sidewalls 23 of the container 11 and frictionally engage the side edge portions of the printed circuit cards 13 so that the cards are slid in and out of the container 11, being guided and stabilized by the slots 17 and the guide tracks 21.

Referring particularly to FIGS. 2 and 3, each of the printed circuit cards 13 is equipped at its front end with a card adapter assembly 25 the purpose of which is to provide a means for latching the cards in the container 11 and to provide a portion that attaches to a card handling tool for unlatching the card and withdrawing it from the container and replacing it in the container. The card adapter 25 comprises an integral substantially cross-shaped member 27 extending along the end edge of the printed circuit cards 13, being joined to the cards through an attaching leg 29 fitted against the surface of the printed circuit card with rivets 31 extending through the card and the leg 29.

Also attached to the printed circuit cards 13 by rivets 31 are a pair of angle elements 33 that form with the cross-shaped member 27 a slot 35 that holds a sliding latch member 37. As shown in FIG. 5, the latch member 37 has a centrally located longitudinal slot 39 that merges into a slightly wider slot 41. At the slotted end of the latch member 37 is an integral projection 43 having a slanted surface 45. On the side of the latch 37 opposite the projection 43 and on the opposite side of the slot 39 is an integral projection 47. The function of the projections 43 and 47 will be explained hereinafter.

The attaching leg 29 of the cross-shaped member 27 has a slot 49 (FIG. 4) at one end thereof. A slot 51 is formed in the central region of the front leg of the member 27. Extensions 53 on the front leg of the member 27 form a recessed section 55 the purpose of which will be subsequently explained. As shown in FIG. 1, each of the cross-shaped members 27 has a further slot 57 through which extends the projection 43 of the latch member 37.

As indicated in FIGS. 2 and 3, the latch 37 is assembled on the cross-shaped member 27 with the attaching leg 29 of the member 27 occupying the slot 39 of the latch and with the wider slot 41 coinciding lengthwise with the slot 49 in the crossmember 27. The space formed by these coinciding slots is occupied by a spring 59 one end of which bears on the closed end of the slot 41 and the other end of which bears on the closed end of the slot 49. Thus the latch 37 is slideable transversely of the container 11 and cards 13 and is spring loaded toward the right in FIG. 2.

The projection 47 acts as a stop for the sliding motion of the latch 37 toward the right by bearing on the end of one of the angle elements 33 (FIG. 2). The integral projection 43 of the latch 37 projecting through the slot 57 provides a cam follower portion by which the latch may be slid from the latched to unlatched position by a card handling tool in a manner to be explained hereinafter. It is apparent from FIG. 2 that when the latch 37 is spring biased to the right while the printed circuit card is in place in the container 11 the end of the latch 37 is behind the corner member 15 of the container 11 and thus locks the printed circuit card in the container. Movement of the latch leftward moves the end of the latch clear of the corner member 15 and permits withdrawal of the card from the container.

The tool for removing the printed circuit cards from the container 11 and for handling the cards and replacing them in the container is illustrated in FIGS. 6 through 9. The tool comprises a handle 63 welded to a vertical tube 65. The lower end of the tube 65 is provided with an integral circular flange 67. Secured to the flange 67 by screws 69 is a substantially square plate 71 from which depends a pair of interlocking elements in the form of cam blades 73 and 75. Each of the cam blades 73 and 75 comprises a camming surface 77. The cam blades and the plate 71, as disclosed, comprise an integral element. The cam blades 73 and 75 are spaced apart as shown in FIGS. 7 and 8.

Disposed between the cam blades 73 and 75 is a longitudinal channel member 79 that is welded to a vertical shaft 81 located within the tube 65 (FIG. 8). The upper end of the shaft 81 is pivotally connected to the handle 63 by a screw 83 and an associated metal washer 85 positioned in a recess 87 in the handle. A second washer 89 is provided and is made of a phenolic material, such as Teflon, to reduce friction during rotation of the handle 63 relative to the washer 85. It is apparent that the cam blades 73 and 75 are rotatable relative to the channel member 79 by rotating the handle 63.

Located centrally of the channel member 79 is a longitudinal recess 89 in both legs of the channel member which recess is of a depth substantially equal to the thickness of the cam blades 73. The length of the recesses 89 somewhat exceeds the length of the cam blades. The lower edges of the channel legs on either side of the recesses 89 are provided with slanted surfaces 91 for guiding the channel member on the portion 55 of the cross-shaped member 27 of the card adapter assembly 25 between the extensions 53. Applied to the lower surface of the plate 71 is a thin layer of friction reducing material 93 which contacts the upper surface of the channel member 79 for the purpose of reducing friction during rotational motion between the channel member 79 and the plate 71.

The manner in which the card handling tool of FIGS. 6 through 8 is used to remove the cards 13 from the container 11 and replace the cards therein will be explained with reference to FIG. 9. To remove a printed circuit card 13 from the container 11 the channel member 79 of the handling tool

is positioned over the outwardly projecting leg of the cross-shaped member 27 of the card adapter, being fitted between the extensions 53. When this is done the slot 51 in the leg of the cross-shaped member 27 coincides with the recesses 89 in the legs of the channel member 79. The handle 63 of the handling tool is then rotated approximately 90° whereupon the cam blades 73 and 75 rotate 90° and extend through the slot 51 as shown in FIG. 9.

Simultaneous with the rotation of the cam blades 73 and 75 one of the cam blades engages the slanted surface 45 on the cam follower projection 43 of the latch 37 to retract the latch and thereby release the printed circuit card for removal from the container. Whether the cam blade 73 or 75 engages the cam follower projection 43 depends on which way the handling tool is turned when it engages the leg of the cross-shaped member. Since the cam blades and the channel member 79 are completely symmetrical it makes no difference which way the channel member is applied to the card adapter.

While the card is removed from the container 11, it is apparent that the card adapter is firmly interlocked with the handling tool and the card may be maneuvered by the handling tool as desired for the purposes required. It is also apparent that the printed circuit card may be quickly and easily replaced in the container 11 with the handling tool by merely reversing the steps followed in removing the printed circuit card. When the printed circuit card has been replaced and the handle is turned counterclockwise the cam blades 73 and 75 will rotate out of the slot 51 and the spring loaded latch 37 will extend and latch the card in the container.

I claim:

1. A tool for engaging and handling an article bearing a projecting, slotted flange and bearing a latch for latching said article in a container comprising:

- a. a flange receiving element having a channel therein adapted for receiving the projecting flange of said article;
- b. an interlocking portion adapted to interlock with the projecting flange of said article rotatably mounted on said tool and disposed along said flange receiving element;
- c. said interlocking portion having a length exceeding the width of said channel of said flange receiving element;
- d. means for turning said interlocking portion either across said channel or longitudinally of said channel;
- e. said interlocking portion being clear of said channel when said interlocking portion is turned longitudinally of said channel.

2. The invention as defined in claim 1 wherein said flange receiving element has an elongated opening formed on both sides of said channel, said openings adapted to correspond with the slot in the projecting flange carried by said article, said interlocking portion being coplanar with said openings whereby said portion extends into said openings when turned transversely of said channel.

3. The invention as defined in claim 1 wherein said means for turning said interlocking portion comprises a handle having a tube projecting therefrom and extending to said flange receiving element, said tube being connected to said interlocking portion, said connection comprising a connecting portion extending between said tube and said interlocking portion.

4. The invention as defined in claim 3 including a pair of said interlocking portions carried by said tool, one of said portions being on each side of said flange receiving element, said interlocking portions being identical but oppositely directed.

5. The invention as defined in claim 3 wherein said tube is rotatable relative to said flange receiving element.

6. The invention as defined in claim 4 wherein each of said interlocking portions has a cam surface on the edge thereof remote from said channel.

7. The invention as defined in claim 6 wherein said tool is combined with said article, said interlocking portions extending transversely of said channel and of said slot in said flange of said article, said article having a latch engaging projection adjacent said flange, said cam surface of one of said inter-

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locking portions slidably contacting said projection whereby said latch is actuated by turning of said interlocking portions.

8. The invention as defined in claim 7 wherein said article comprises a printed circuit card, said card being slidable in and out of a container.

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9. The invention as defined in claim 7 wherein said flange has a recess in the projecting edge thereof, said recess being of a length corresponding to the length of said flange receiving element, said flange receiving element fitting in said recess.

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