The present invention relates to a detachable handle for forcibly manipulating an electronic plug-in unit, and more particularly, to a handle which may be attached to a thin electronic plug-in unit to exert a precise and forcible control of the movement of the unit.

The detachable handle of the present invention is described herein in its most important application, namely, that of being selectively attached to an electronic plug-in unit for inserting it into, or removing it from, a minia
ture electronic assembly. The described plug-in unit includes a gripping portion in the form of a thin plate to which the detachable handle of the present invention is attached.

In the packaging of modern electronic equipment a conventional type of construction which is widely used is a tier, or box, having a plurality of pairs of grooves on the inner surfaces of its two sides so that a corresponding plurality of wiring panels may be inserted therein. The wiring panels themselves are frequently of the printed circuit type consisting of an insulating material having some electrical circuit components printed or painted thereon, and frequently having provision for the mounting of other components of conventional types. In order to make the most efficient use of space, it is desirable to mount the panels very closely together within the tier.

A necessary feature of this type of packaging, however, is a provision for removing the various individual panels from the tier from time to time for purposes of inspection or maintenance. It is therefore desirable to provide a device for inserting and removing the panels from the tier.

The principal advantage of such a device is that it permits the panels much more closely together than if it were necessary to provide working space to insert them or remove them by hand.

In the conventional tier described above, each panel must not only be inserted into its proper position, but must also be provided with necessary electrical connections. For this purpose, a bank of connector terminals is mounted on the bottom of the tier running transversely across the tier from one set of grooves to the associated groove on the inner surface of the opposite wall, and a corresponding bank of connectors is mounted on that edge of the panel which is inserted first into the tier. When the panel is inserted into its final position, therefore, the bank of connectors on the leading edge of the tier meshes with the corresponding bank of connectors on the bottom of the tier mesh together, usually by some type of spring contact. A considerable amount of force must be exerted in order to mesh the banks of connectors together when the panel is inserted, or to pull them apart when the panel is removed. In addition, when the panel is being inserted its direction of movement must be carefully controlled. The requirements placed upon the device noted above, therefore, are that it must operate within a very confined space, must exert a precise control over the direction of motion of the panel, and must be able to exert considerable force in controlling the motion of the panel. These requirements are met by the detachable handle of the present invention.

It is, therefore, an object of the present invention to provide a detachable handle suitable for forcibly manipulating a thin plate within a relatively confined space.

Another object of the present invention is to provide a detachable handle which may be attached to an electronic plug-in unit in a confined working space too small for human hands.

According to the present invention there is provided a detachable handle for an electronic plug-in unit, including a body portion adapted to be gripped by hand, a locking member movably mounted on the body portion and adapted to occupy either a locked position or an unlocked position, and spring means normally retaining the locking member in its locked position. The body portion has at one end thereof a substantially U-shaped groove for engaging the plug-in unit. Each of the opposing walls of the groove has a plurality of holes respectively aligned with the corresponding holes in the opposite wall.

The locking member has mounted upon it, opposite the holes in the groove, a plurality of metal locking pins arranged in a configuration identical to the configuration of the holes in the groove. In the locked position of the locking member the metal locking pins extend through the holes in one wall of the groove, across the groove, and into the holes in the other wall of the groove; whereas in the unlocked position the metal locking pins are fully withdrawn from the groove.

The features of this invention which are believed to be novel and patentable are pointed out in the claims which form a part of this specification. For a better understanding of the invention, reference is now made to the accompanying drawing, in which:

- Figure 1 is a partially cutaway view of an electronic tier assembly illustrating four wiring panels mounted in position within the tier and showing a detachable handle in accordance with the present invention engaging one of the panels;
- Figure 2 is an elevation view of the detachable handle of Figure 1 showing the normal locked position of the locking member;
- Figure 3 is a view similar to Figure 2, but showing the unlocked position of the locking member;
- Figure 4 is a bottom view of the handle of Figure 2 looking toward the U-shaped groove as indicated by arrow 4;
- Figure 5 is a side view of a portion of the tier of Figure 1 illustrating the working space between adjacent panels for attaching and detaching the handle, and the meshing of mated banks of connectors at the bottom of the tier; and
- Figure 6 illustrates the insertion or removal of one of the panels by means of the detachable handle.

Referring now to Figure 1 of the drawing, there is illustrated therein an electronic assembly tier 10 in which wiring panels 21, 22, 23 and 24 are mounted. A detachable handle 30 in accordance with the present invention is attached to panel 23.

The tier is in the form of a box or trough including a lefthand wall 11 having grooves, such as 11a, 11b on the inner surface thereof, and a righthand wall 12, having grooves such as 12a on its inner surface. Each of the panels is positioned in a corresponding pair of the grooves, for example, panel 21 is positioned in grooves 11a and 12a. The panels are indicated as having printed circuit wiring mounted thereon in the conventional manner. A bank 13 of female electrical connectors mounted on the bottom of the tier meshes with a corresponding bank of male connectors (shown only in dotted lines) in Figure 5 mounted on the bottom edge of panel 23.

In Figure 1 detachable handle 30 is illustrated as being
locked into position on the upper edge of panel 23. Dotted lines to the right of handle 30 illustrate an alternative position in which it may be placed and then slid to the left in order to be centered and locked into position on the panel in a manner which will be subsequently described.

Various details of the detachable handle are illustrated in various figures of the drawing with the same reference numerals used throughout for the same parts. Therefore, the detachable handle will be described with reference to all of the figures.

In Figure 1 each of the wiring panels is illustrated as having an upper portion in the form of a thin plate suitable for attaching the handle thereto. On the upper portion of each panel there is located a row of four holes having predetermined relative spacings, and a centering slot. For example, panel 21 has holes 21a, 21b, 21c and 21d located near its upper edge. A centering slot 21e is located in the upper portion of the panel at approximately the center.

The body portion of detachable handle 30 includes on its bottom surface a long U-shaped groove 31 having pairs of holes 31a, 31b, 31c and 31d passing through the walls of the groove. A predetermined spacing is provided between adjacent pairs of holes to match the spacings between corresponding holes on panel 23. A center pin 31e is permanently mounted in the center of the U-shaped groove of handle 30 in such a position as to engage the centering slot on one of the panels when the handle is in the proper position. Although it is not necessary that the spacings between adjacent holes in the edge of each panel be equidistant, it is nevertheless preferred that the detachable handle be reversible. Thus, it is preferred that both the panels and the handle be so arranged that either end of the U-shaped groove may be positioned at either end of the gripping edge of the panel. This preferred form is illustrated in the drawing. The rows of holes in the gripping portion of each panel and in the U-shaped groove of the handle are therefore not only spaced at equal intervals, but are arranged in a balanced or symmetrical configuration with respect to the center of the panel and of the handle.

The detachable handle further includes a hand-grip 32 which is provided on the body portion of the handle. In the preferred form of the handle illustrated in the drawing, the body portion of the handle is a hollow rectangle, the exterior surface of which is a U-shaped rectangle providing the U-shaped groove 31, and the opposite side of the rectangle providing the hand-grip. A locking member 33 having a row of metal locking pins 33a, 33b, 33c and 33d provides the means for locking the detachable handle to one of the panels when the corresponding rows of holes have been appropriately aligned. Locking member 33 is pivotally mounted on a pivot rod 34 which is parallel to the U-shaped groove and is fixedly mounted upon the body portion of the handle. To provide the pivotal mounting, locking member 33 has extended portions on each side which are bent at right angles to the main portion of the member and pass through holes with which the pivot rod passes. Locking member 33 on its upper extremity has a finger tab 33f which is inclined outwardly and provides a suitable means for controlling rotation of the locking member with respect to the pivot rod. A spring 35, preferably consisting of a flat piece of leaf spring steel, has one end rigidly fastened to the back side of tab 33f (as viewed in Figure 1) passes between locking member 33 and pivot rod 34 and has its other end resting on the back side of the rectangular body portion which carries the grooved surface (the lower side as viewed in Figure 1). Spring 35, therefore, exerts a normal force on tab 33f to retain locking member 33 in its locked position, that is, with the locking pins passing through the corresponding pairs of holes in the walls of the U-shaped groove.
said aligning pin being adapted to mate with a passage-
way in said unit constructed to receive said aligning pin
during insertion of said unit into said handle for de-
termining the position of said unit relative to said han-
dle.

2. A detachable handle for an electronic plug-in unit
including a thin plate having a perforated outer edge,
said handle comprising: a body portion adapted to be
gripped by hand and having a substantially U-shaped
groove at one end thereof for engaging said thin plate,
each of the opposing walls of said groove having a pla-
ularity of holes therein respectively aligned with the cor-
responding holes in the opposite wall; a locking member
hinged to and movably mounted on said body portion and
having a plurality of metal locking pins mounted thereon
opposite said holes and in a configuration identical to
that of said pluralities of holes, said locking member
being mounted to occupy either a locked position
in which said plurality of metal locking pins extend through
the plurality of holes in one wall of said groove, across
groove, and into the plurality of holes in the other
wall of said groove, or an unlocked position in which
said plurality of metal locking pins are fully withdrawn
from said groove; spring means normally retaining said
locking member in said locked position; means limiting
the motion of said locking member so that in its un-
locked position said plurality of metal locking pins are
only partially withdrawn from the plurality of holes in
said one wall of said groove; and means operable when
said locking member is in said unlocked position and the
outer edge of the plate is inserted into said groove for
automatically establishing a predetermined position of
the handle with respect to the plug-in unit, said last-
named means including an aligning pin permanently po-

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