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DUAL PLUG-IN MODULE  
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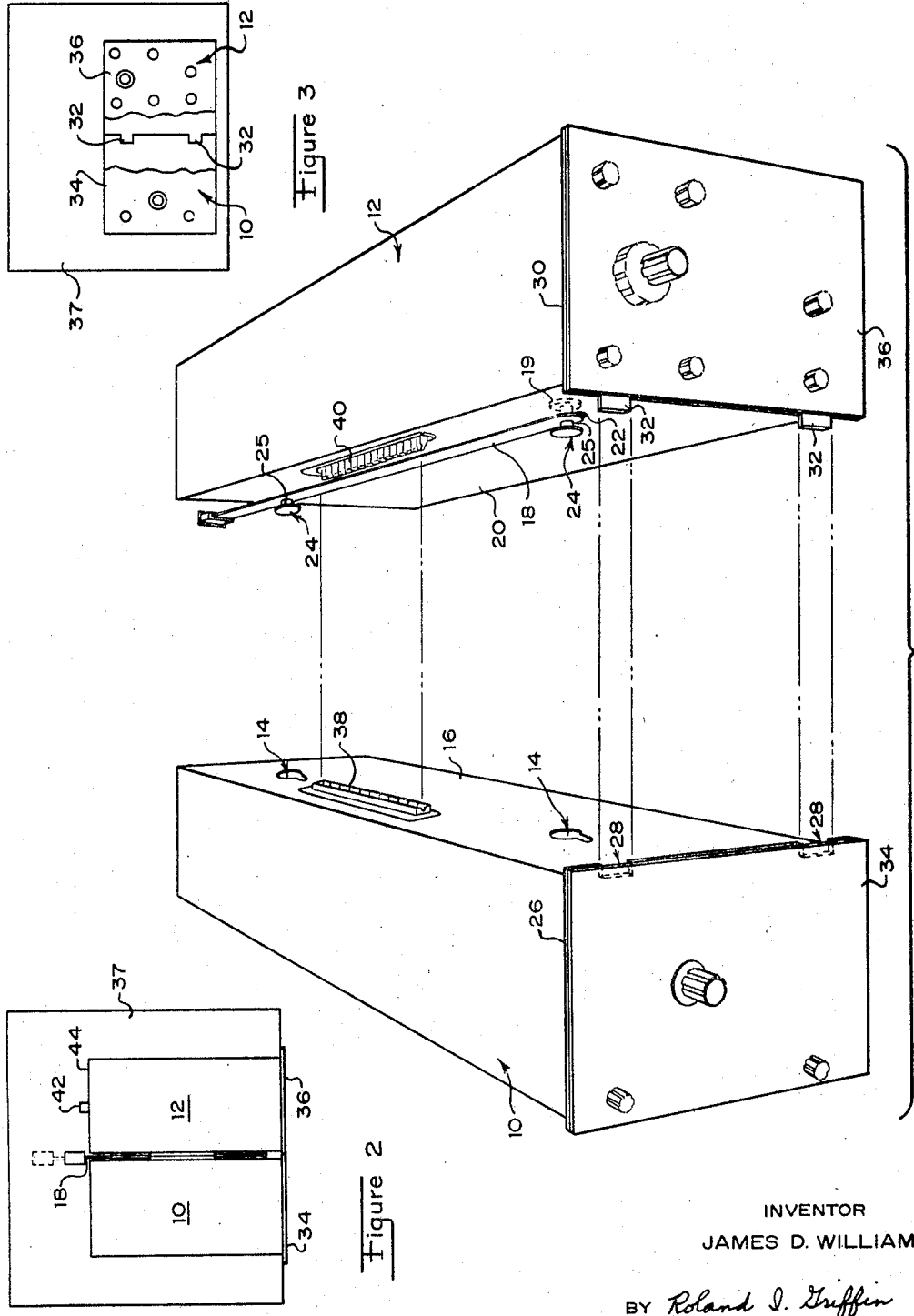


Figure 3

Figure 1

Figure 2

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### DUAL PLUG-IN MODULE

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### ABSTRACT OF THE DISCLOSURE

A pair of mechanically separate and electrically related plug-in units are mechanically and electrically mated in side-by-side relationship to form a unitary plug-in module for insertion into a single cavity of a main instrument.

This invention relates to mechanically separate but electrically related plug-in units that are mechanically and electrically mated to form a dual plug-in module for insertion into a high frequency instrument such as an oscilloscope.

In order to increase the versatility of an oscilloscope system the horizontal and vertical deflection circuits for the cathode ray tube are often housed in separate horizontal and vertical plug-in units, which may be mechanically and electrically attached to and detached from the basic display instrument. It is then possible, for example, to substitute a delayed sweep horizontal plug-in unit for a standard sweep horizontal plug-in unit without also replacing the vertical plug-in unit. Typically, these separate horizontal and vertical plug-in units are each inserted into a separate cavity of the basic instrument and are each separately attached mechanically and electrically to the basic instrument. This increases the hardware such as mechanical guides and latches and electrical connectors required to mechanically and electrically attach the plug-in units to the basic instrument and therefore increases the cost of the oscilloscope system. Moreover, interconnecting circuitry between the plug-in units must be routed out the back end of one plug-in unit through a set of connectors, along signal transmission leads, and into the back end of the other plug-in unit through another set of connectors. These additional connections also increase the cost of the oscilloscope system and, in addition, increase the lead inductance and capacitance and the contact potential associated with the interconnections between the plug-in units thereby increasing the signal loss during signal transfer between the plug-in units.

Accordingly, it is the principal object of this invention to reduce the mechanical and electrical hardware required to mechanically and electrically attach a pair of mechanically separate but electrically related plug-in units to a basic instrument and to make the required electrical interconnections between the plug-in units more direct so as to reduce the lead inductance and capacitance and the contact potential associated with these electrical interconnections.

This object is accomplished in accordance with the illustrated embodiment of this invention by providing a pair of plug-in units mechanically and electrically mating in side-by-side relationship so as to form a dual plug-in module for insertion into a single cavity of the basic instrument.

Other and incidental objects of this invention will be apparent from a reading of this specification and an inspection of the accompanying drawing in which:

FIGURE 1 is a perspective view of a pair of mechanically and electrically mating plug-in units according to

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FIGURE 2 is a top view of the plug-in units of FIGURE 1 after they have been mechanically and electrically mated and inserted into the cavity of the basic instrument; and

FIGURE 3 is a partially cut-away front view of the mechanically and electrically mated plug-in units of FIGURE 2.

Referring now to the drawings, and particularly to FIGURE 1, there is shown a pair of mechanically separate but electrically related plug-in units 10 and 12 comprising, for example, the vertical and horizontal deflection circuits of an oscilloscope system. A pair of keyhole slots 14 are formed in a side panel 16 of the plug-in unit 10, and a latch member 18 is slidably mounted on an adjacent side panel 20 of the plug-in unit 12. This latch member 18 may be mounted by forming a pair of narrow slots 22 in the side panel 20 of the plug-in unit 12, inserting through each slot 22 the shank of a separate retaining bolt 19 having a circular head larger in diameter than the width of the slot 22, and fastening the shank of each retaining bolt 19 to the latch member 18 so as to restrict the latch member 18 to sliding movement between the opposite extremities of the slots 22. A pair of latch buttons 24 are fixedly attached to the latch member 18 so that each latch button registers with the wide portion of a different one of the keyhole slots 14 when the latch member 18 is pulled out as shown in FIGURE 1. Each of these latch buttons 24 is adapted to fit through the wide portion of the corresponding keyhole slot 14 and has a shank 25 that is adapted to fit into the narrow portion of the corresponding keyhole slot 14 when the latch member 18 is pushed in as shown in FIGURE 2. A front subpanel 26 of the plug-in unit 10 is provided with a pair of notches 28, and a front subpanel 30 of the plug-in unit 12 is provided with a corresponding pair of tabs 32 that are adapted to fit into and engage the notches 28 of the front subpanel 26 when the plug-in units 10 and 12 are mechanically mated. This arrangement of notches 28 and tabs 32 insures proper alignment of the front panels 34 and 36 of the plug-in units 10 and 12 and prevents the front panels 34 and 36 from slipping, vertically, forward, or backward relative to one another since the notches 28 and the tabs 32 have been engaged. The plug-in units 10 and 12 are mechanically attached by pulling out the latch member 18 as shown in FIGURE 1 and as indicated by the dashed position of the latch member 18 shown in FIGURE 2, fitting each latch button 24 through the wide portion of the corresponding keyhole slot 14, and engaging the notches 28 and the tabs 32 of the front subpanels 26 and 30 as shown in FIGURE 3. The latch member 18 is then pushed in as shown in FIGURE 2 so that the shank 25 of each latch button 24 fits into the narrow portion of the corresponding keyhole slot 14. This locks the plug-in units 10 and 12 together so as to form a dual plug-in module and prevents relative motion between the plug-in units of this module. The hardware such as guides and latches required to insert this dual plug-in module into a single cavity of a basic instrument 37 is no greater than that normally required for a single plug-in unit.

The plug-in units 10 and 12 are electrically mated together through a multi-terminal female connector 38 mounted on the side panel 16 of the plug-in unit 10 and by a corresponding multi-terminal male connector 40 mounted on the side panel 20 of the plug-in unit 12. The male connector 40 is adapted for mating with the female connector 38 when the plug-in units 10 and 12 are mechanically locked together. This direct connection between the plug-in units 10 and 12 substantially reduces the length of the interconnecting leads conventionally used between the plug-in units 10 and 12 and therefore reduces

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interconnecting leads. Thus, the loss of signal because of lead inductance and capacitance is substantially reduced. Moreover, since only one set of connectors is used the contact potential and hence the signal loss due to contact potential is cut in half. The power for both plug-in units 10 and 12 is derived from the basic instrument 37 through a single connector 42 mounted on the back panel 44 of the plug-in unit 12. The plug-in unit 10 receives its power from the plug-in unit 12 and therefore need not be electrically connected to the basic instrument 37. This feature in combination with the direct connection between the plug-in units 10 and 12 substantially reduces the number of connectors required by the plug-in units.

I claim:

1. Plug-in apparatus for insertion into a single cavity of an electrical instrument, said apparatus comprising:

A first plug-in unit for the electrical instrument, said first plug-in unit having an electrical connector and a mechanical connector; and

a mechanically separate second plug-in unit for the electrical instrument, said second plug-in unit having an electrical connector releasably engageable with the electrical connector of the first plug-in unit to provide an electrical signal conduction path between the plug-in units, said second plug-in unit also having a mechanical connector releasably engageable with the mechanical connector of the first plug-in unit for releasably mating the plug-in units together in a first direction to provide a unitary plug-in module for insertion into the cavity of the electrical instrument in a second direction substantially normal to said first direction;

at least one of said unitary plug-in module and said electrical instrument including means for electrically connecting said unitary plug-in module and said electrical instrument upon insertion of the unitary plug-in module into the cavity of the electrical instrument.

2. Plug-in apparatus as in claim 1 wherein said means comprises an additional electrical connector of at least one of the plug-in units, said additional electrical connector being operable for electrically engaging the electrical instrument upon insertion of the unitary plug-in module into the cavity of the electrical instrument in said second direction.

3. Plug-in apparatus as in claim 2 wherein: said first plug-in unit has a front panel and has a side panel including the electrical and mechanical connectors of the first plug-in unit; and

said second plug-in unit has a front panel and has a side panel including the electrical and mechanical connectors of the second plug-in unit;

whereby engagement of the electrical and mechanical connectors of the first plug-in unit with the electrical and mechanical connectors of the second plug-in unit

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electrically and mechanically mates these side panels of the plug-in units together in said first direction to provide the unitary plug-in module, the plug-in units of said unitary plug-in module having their front panels disposed in a common plane substantially normal to said second direction.

4. Plug-in apparatus as in claim 3 wherein: the electrical connector mounted on the side panel of one of said plug-in units comprises a female connector;

the electrical connector mounted on the side panel of the other of said plug-in units comprises a male connector;

one of said mechanical connectors comprises a pair of spaced keyhole slots in the side panel of one of the plug-in units, each of said keyhole slots having an enlarged portion and a narrow portion; and

the other of said mechanical connectors comprises a latch slidably mounted on the side panel of the other of the plug-in units, said latch being operable in one position for entering the enlarged portions of the keyhole slots and then being slid to another position for engaging the narrow portions of the keyhole slots to releasably mate the plug-in units together and provide the unitary plug-in module.

5. Plug-in apparatus as in claim 4 wherein: one of said plug-in units has a housing including the front and side panels of that plug-in unit and having a notch; and

the other of said plug-in units has a housing including the front and side panels of that plug-in unit and having a tab for engaging said notch when the plug-in units are electrically and mechanically mated together thereby preventing relative movement of one plug-in unit with respect to the other in planes that are parallel to said second direction.

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