

Dec. 16, 1958

R. P. WITT ET AL
PLUG-IN PACKAGES

2,864,977

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3 Sheets-Sheet 1

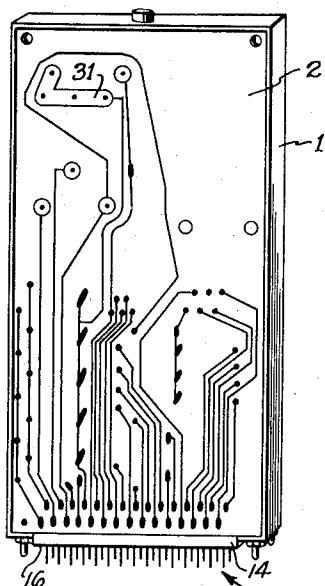


Fig. 1-A

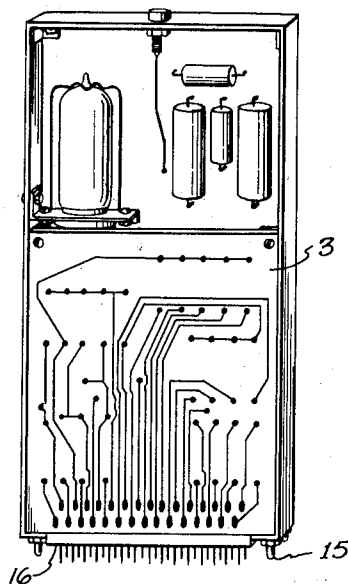


Fig. 1-C

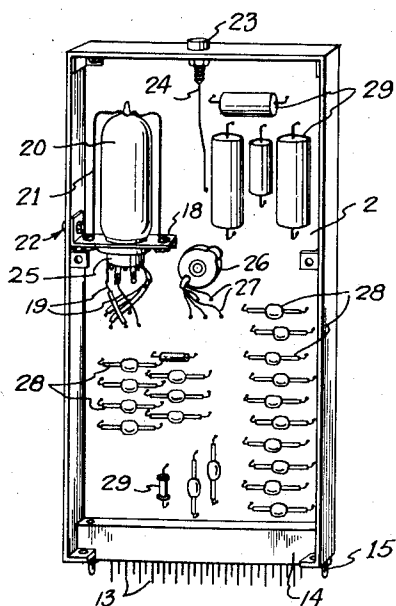


Fig. 1-B

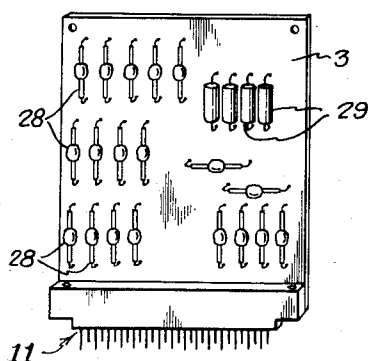


Fig. 1-D

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3 Sheets-Sheet 2

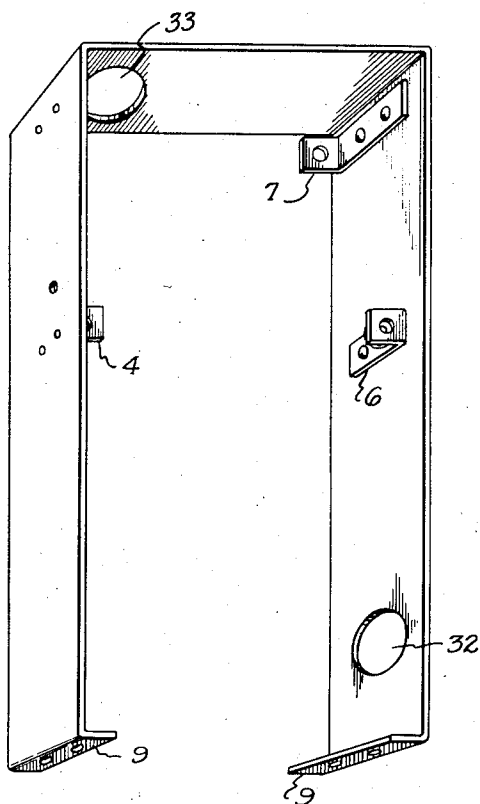


Fig. 2

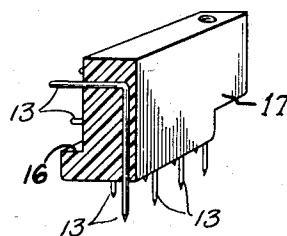


Fig. 3

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3 Sheets-Sheet 3

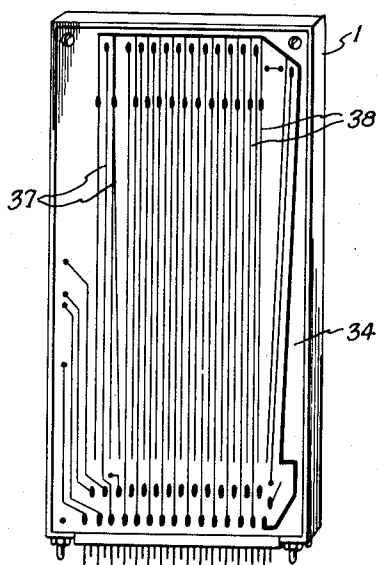


Fig. 4-A

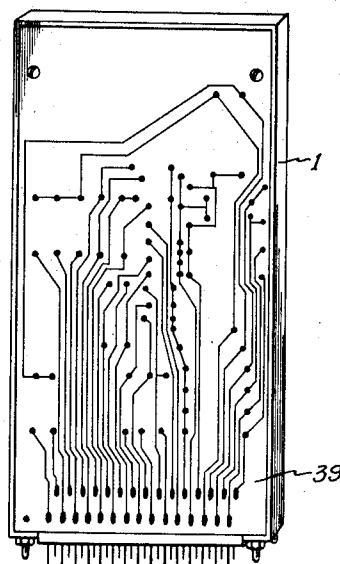


Fig. 4-C

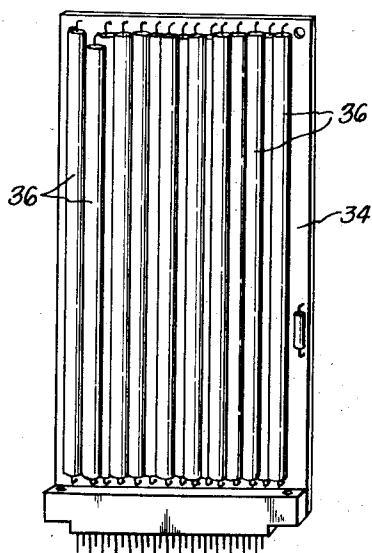


Fig. 4-B

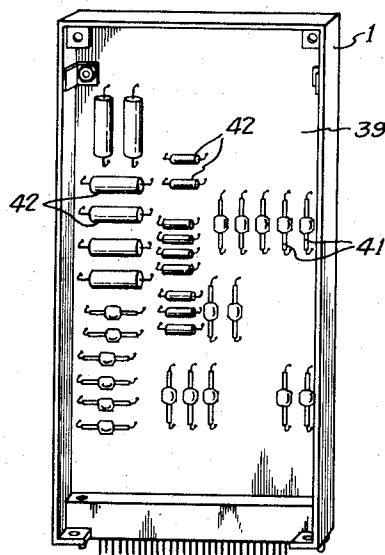


Fig. 4-D

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2,864,977

PLUG-IN PACKAGES

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Application October 14, 1953, Serial No. 387,818

2 Claims. (Cl. 317-101)

The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to us of any royalty thereon in accordance with the provisions of 35 United States Code (1952) section 266.

The present invention relates to plug-in packages for use in electronic computing machines and in particular to the physical structure of these packages.

The large number of circuit components in the modern electronic computer makes it essential that methods be devised to provide for rapid servicing of the machines. In an effort to provide for this rapid servicing the designers of computers are relying more and more on the service technique of package replacement. In this approach to the problem when an individual unit is found to be malfunctioning, it is replaced by a new unit and the old unit is sent elsewhere for repair. The packages to be used in such machines must provide protection for the various elements in the package against physical damage, and this necessitates that the elements of the package be enclosed within the package at least to some extent. On the other hand the serviceman must be able to open up the package easily in order to allow rapid repair or replacement of the defective element or elements.

Another problem which faces the designers of plug-in packages is that of providing all the necessary circuitry in the minimum number of packages. To accomplish this methods must be devised by which a small number of different types of packages may be easily adapted to perform a great variety of functions. Otherwise large numbers of different types of packages would have to be carried in stock, and this would make the cost of the system practically prohibitive.

It is an object of the present invention to provide plug-in packages for electrical circuits in which all of the components of the packages are mounted on panels, all wiring between panels being accomplished through a prewired female receptacle into which the package is plugged.

Another object of the present invention is to provide plug-in packages for electrical circuits in which a split male connector is used so that the package may be easily opened.

It is another object of the present invention to provide plug-in packages for electronic computers in which the wiring between components on each panel of the package is accomplished by means of etched or printed circuit techniques.

It is another object of the present invention to provide plug-in packages, much of the wiring of which is completed when the package is plugged into a prewired female receptacle, thereby allowing the package to be adapted to its particular function when it is inserted in the circuit.

It is another object of the present invention to provide plug-in packages for electrical circuits which are so constructed that most of soldering may be accomplished at one time.

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It is another object of the present invention to provide plug-in packages for electrical circuits which are so constructed that most of the leads may be formed in the same operation.

5 Another object of the present invention is to provide an electrical assembly in which all of the electrical elements are carried in packaged units which are plugged into prewired female receptacles mounted on the assembly rack.

10 In accordance with the present invention there is provided a metal U-shaped frame to which are bolted two panels of insulating material, each panel being mounted on an opposite side of the frame. The outer surfaces of the panels have provided thereon etched circuits for inter-
15 connecting the various elements of the package which are mounted on the inside of that particular panel. Each panel carries on one end thereof one-half of a split male plug to which various etched circuit leads may be connected in a predetermined arrangement. Therefore, when
20 it is necessary to open the package, either panel may be removed separately, since all connections between the two panels are made through a prewired female receptacle into which the male plug is inserted. In this particular arrangement all of the circuit elements are arranged along
25 the inside of the panels so that they are protected against damage which might otherwise result from striking of the components. The leads which are etched along the outer surface of the panel may be considered for all practical purposes to be in the same plane as the outer surface of
30 the panel, and therefore are particularly unsuceptible to damage.

Other uses and advantages of the invention will become apparent upon reference to the specification and drawings.

Figure 1, which is composed of Figures 1A, 1B, 1C, and 1D shows various views of one type of plug-in package made in accordance with the present invention.

Figure 2 is a detailed view of the frame of the package of the present invention.

Figure 3 is a detailed view of one half of the split male connector which is used in the present invention.

Figure 4, which is composed of Figures 4A, 4B, 4C, and 4D, shows a slightly different type of physical arrangement for plug-in packages.

Referring to Figure 1, the package consists of a
45 U-shaped metal frame 1, which merely provides a structure on which to mount the panels 2 and 3. These panels carry all of the electrical components and all of the wiring, none of the components or wiring being attached to the U-shaped frame.

50 The frame 1, which is shown in greater detail in Figure 2, consists essentially of a U-shaped member, the depth of the frame being governed by the size of the components to be mounted therein. Small protrusions 4, 6, and 7 are provided at various positions on the frame, these protrusions serving as mechanical supports for the panels and also providing means for securing the panels to the frame. The turned-under portions or projections 9 at the bottom of the frame are provided to give additional support to the panels, the projections 9 actually engaging the split male connector which is secured at the bottom of
55 each panel. Holes are drilled in the sides of the frame 1, as shown in Figure 2 to permit forced-air ventilation of the package. The hole 32 receives air from a cool air duct which is carried on the main chassis of the machine, the return path being through hole 33.

Figures 1A and 1B show the outer and inner sides respectively of panel 2, while Figures 1C and 1D show the outer and inner sides respectively of panel 3. The
60 panel 2 has mounted on its lower portion one-half 11 of the split male connector. The panel 3 has mounted at

its lower end the other half 12 of the split male connector.

The split male connector is shown in greater detail in Figure 3. The pins 13 which are designed to be plugged into the female receptacle are anchored in an insulating block 14. Each pin is turned at an angle inside of the block so as to proceed out of the front thereof. Each protrusion is inserted through a hole in the panel and is soldered to the printed lead on the panel which connects with that particular hole.

A shoulder 16 is provided on a block to support the bottom edge of the panel. Both ends of the block are cut back to provide shoulders 17 which seat on the projections 9 of frame 1.

The panels with their associated connectors are bolted to the frame 1 by means of screws which fasten to protrusions 4, 6 and 7 and by aligning pins 15 which extend through the projections 9 and screw into the shoulder 17 of the block. There are four such pins for each package; the pins being of various diameters so that the package cannot be inserted in the wrong way.

The panels 2 and 3 are made up of thin sheets of Bakelite or other suitable insulating material and all wiring is accomplished by etched or printed leads which are formed on these panels. The etched leads are carried on the outside of the panel while the components are mounted on the inner surfaces. The particular package shown in the various drawings of Figure 1 is known as a tube package. It provides for various gating and amplifying functions for the computer. Depending upon the degree of flexibility required by the design features of the computer, various of these elements will be interconnected by the etched leads, while others will be interconnected externally. The components which are interconnected externally will be soldered to leads which connect with the various pins of the male connector. If a particular component on one panel must be connected to a component on another panel, the terminals of these components will be connected from etched leads to pins of the male connector and the connection between the two elements will be accomplished in a prewired female receptacle into which the male plug fits. One or more tubes may be mounted in this package in the manner shown in Figure 1B. The frame 18 is secured to the panel 2, the frame carrying a tube base 25. The pins of the tube base are connected by means of wires 19 to various etched leads on the outside of the panel. The tube 20 is held in place by means of a spring clip 21, which keeps the tube from working loose. Provisions may be made to bolt the frame 18 to the frame 1 when the package is assembled. This is shown at 22 in Figure 1B. Jack 23 is inserted through a hole on the frame 1 and is connected by a wire 24 to one of the printed leads on the outside of the panel. Jack 23 and lead 24 provide a convenient means for testing the wave forms at any particular point in the package circuit. In the arrangement shown, the wire 24 is connected to the output of the tube 18. In the embodiment shown a transformer 26 is connected in the output circuit of the tube 20, this transformer being mounted on the panel 2, its wires 27 being connected to appropriate circuit leads. The various other elements shown on the panels 2 and 3 are diode rectifiers 28 and resistors 29. All of the elements in the package are mounted on the inside of the panel and are connected to the leads on the outside through holes in the panel, the element lead wire being soldered to the etched circuits. The heavy lead 31 shown on panel 2 in Figure 1A carries a high current and therefore is made rather heavy.

Another type of package made up in accordance with the present invention is shown in Figure 4. This package, which is known as a delay-line package is very similar in construction to the tube package. Again the split base and printed leads are used and all connections are made in the same manner. The panel 34, shown in Figures 4A and 4B carries a number of electrical delay

lines 36 on its inner surface. The terminals of the delay lines are connected through holes in the panel 34 to the printed leads 37 carried on the outside of the panel. The panel 34 has printed on it in addition to the normal circuit leads a Faraday grid, which is composed of a series of grounded parallel printed leads 38. This grid reduces crosstalk between the leads to the various delay lines. Figures 4C and 4D show the panel 39 which carries the input and output termination circuits which are necessary for use with this type of electrical delay line. The circuits are provided by the diodes 41 and resistors 42, which are mounted on the inside of the panel 39. The connections between the input and termination circuits on the one hand and the delay lines on the other hand are made through split male connector and female receptacle. The methods for mounting the panels on the frame 1 are the same as described with reference to Figure 1.

The above construction provides for a mechanically sound package unit which protects the various components and which at the same time can be readily disassembled for servicing. This latter feature is provided by the use of the split male connector and the avoidance of any internal connections between the two panels, all connections between these panels being made through the base.

As a result of the use of etched circuits, the package may be readily fabricated, since most wiring is accomplished at one time during the etching process, which in itself is comparatively rapid. Also, since the layout of the leads may be prearranged, and since the leads cannot move once formed, the package can be designed for a minimum of cross talk between the various circuits. Although etched circuits have been referred to specifically, printed circuits and other similar techniques may be used. Also in the fabrication of such a package, all of the components may be assembled on the panel and all soldering may be accomplished at one time by dip soldering.

Of extreme importance in the electronic computer art is the fact that much of the interconnection between the components is accomplished when the package is plugged into a socket which has been previously wired, thereby providing a great deal of flexibility in the application of a particular package. A number of female receptacles are mounted on a rack, the wiring between packages and between the panels of a single package being accomplished by appropriate wiring between the terminals of the female receptacle. The actual electrical arrangement of the basic components of a computer within the package is set forth in detail and claimed in copending application Serial No. 375,846, for Plug-in Packages for Electronic Circuits, filed on August 21, 1953, by Richard P. Witt, one of the present coinventors.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of our invention as defined in the appended claims.

What is claimed is:

1. A package unit for use in electrical circuits which comprises a U-shaped frame defining a relatively thin housing having a top and end walls, open sides, and an open bottom and having an inwardly turned flange on each end wall projecting into said open bottom, two panels of insulating material, means for selectively securing one end of each of said panels to said bottom flanges, means for selectively securing the other end of each of said panels to the end walls of said frame, said panels lying in parallel planes along the respective edges of said frame, a number of electrical components mounted on a first side of each of said panels, a predetermined configuration of conductive leads lying along the surface of the observe side of each of said panels, a plug having two similar sections, one of said sections being similarly mounted on said first side of each of said panels

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and projecting beyond said one end thereof, each of said plug sections having a first shoulder portion in one face thereof to which a panel is secured in a manner such that said obverse side of each panel and associated plug lie within the plane of the sides of said frame and second shoulder portions in the bottom face of the plug adapted to seat on said inwardly turned flanges; said panels mounted so that said first one side of each panel together with the associated plug section face the other, said plug sections being aligned adjacent each other to form a single plug for said entire unit when the panels are mounted in said frame, said conductive leads on each respective panel being connected with contact members of the plug section mounted on that panel and means connecting said electrical components mounted on each respective panel with various portions of the conductive leads on that panel.

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2. The invention according to claim 1 in which at least one platform is attached to one of said panels and a tube base mounted on said platform, said tube base having its pins connected to predetermined etched leads.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,864,977

December 16, 1958

Richard P. Witt et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 74, for "observe" read -- obverse --.

Signed and sealed this 10th day of March 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

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