

United States Patent

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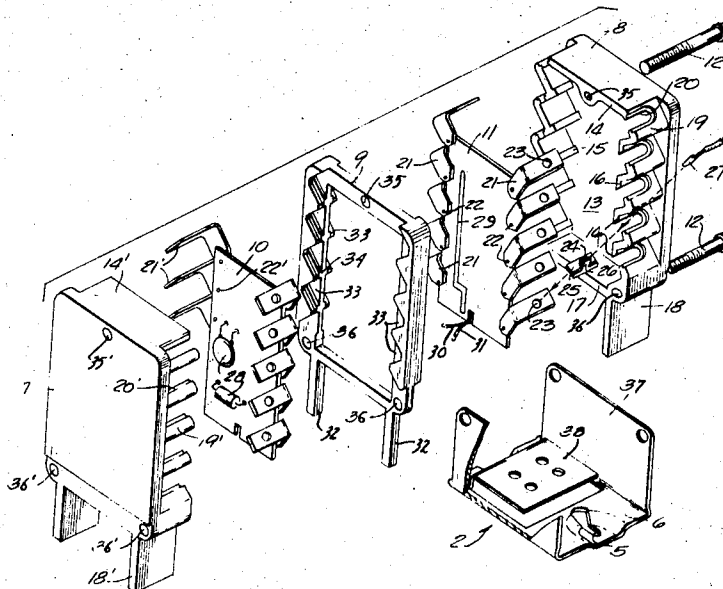
[54] **ELECTRICAL HOUSING ASSEMBLY HAVING A PLURALITY OF CHAMBERS WITH ADJACENT CIRCUIT BOARD ELEMENTS**
10 Claims, 3 Drawing Figs.

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317/101, 339/17
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H05k 1/14
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100, 101 (D) (DH) (CM), 113, 118, 120; 339/17
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ABSTRACT: This disclosure includes a housing assembly which can directly replace the usual electromagnetic contactor. The assembly includes opposed similar end housing sections including inwardly projecting and aligned sidewalls. A shallow intermediate wall is interposed between the opposite end sections. Contact boards are provided with a plurality of contact lugs which project outwardly and upwardly along the opposite side edges. The boards are disposed between the end sections and intermediate wall with the contact lugs mating with recesses in the intermediate wall and firmly clamped in place by the ends of the sidewalls of the end sections.

Components are mounted to the circuit boards facing the end sections with printed connections to the opposite side.



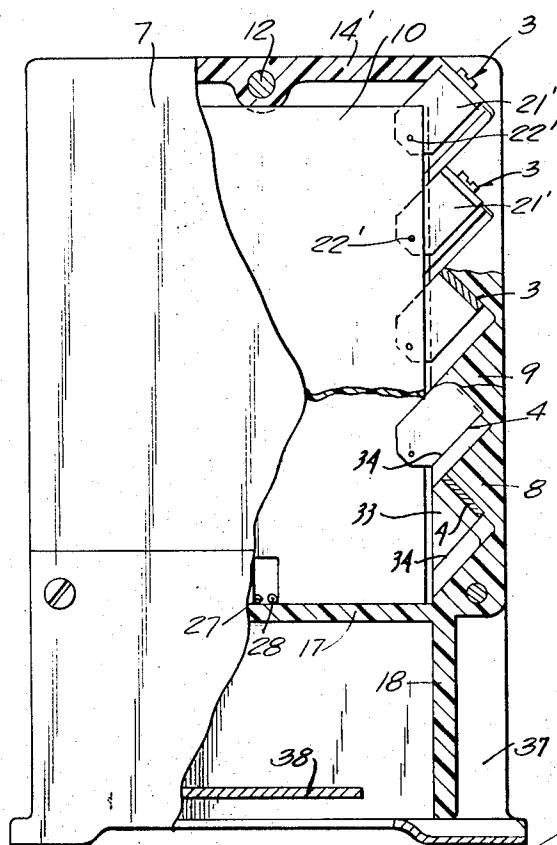


Fig. 3

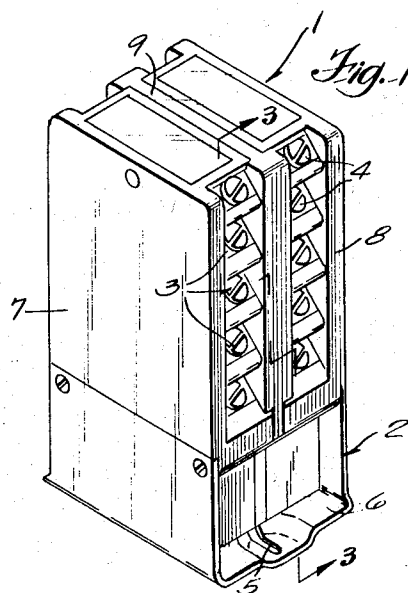


Fig. 1

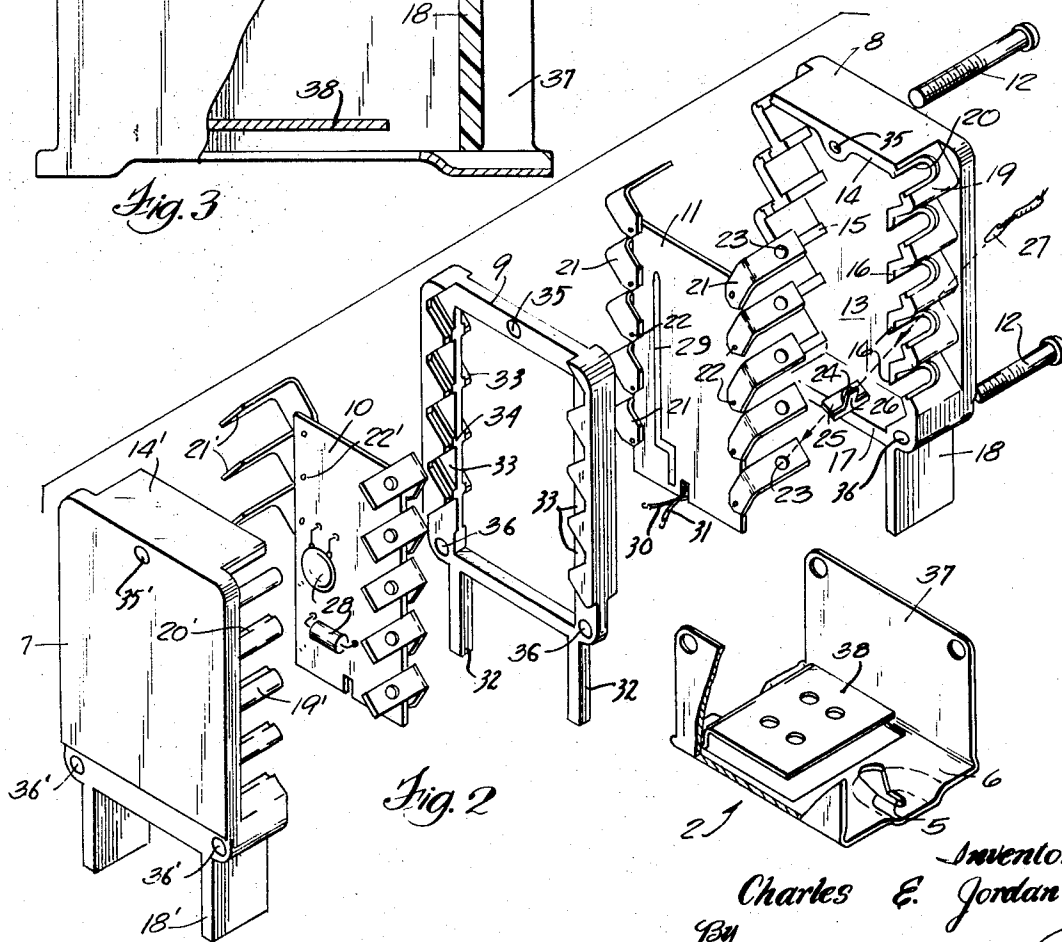


Fig. 2

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ELECTRICAL HOUSING ASSEMBLY HAVING A PLURALITY OF CHAMBERS WITH ADJACENT CIRCUIT BOARD ELEMENTS

This invention relates to a switch housing assembly and particularly to a housing for a static switch relay.

In industrial processing and machine control, control panels are often provided and support the various control and switching elements. Electromagnetic contactors or relays are widely employed and generally uniform standards have been established relating to the overall configuration and in particular the mounting of such devices. The construction and mounting requirement are such that they should be readily accessible while employing a minimal amount of mounting area. In connection with solid-state switching units, it is important to provide for adequate heat dissipation as well as minimizing of the packaging and mounting expense.

The present invention is particularly directed to a versatile and relatively inexpensive housing construction which may include a substantial number of contact connections means and which is particularly adapted to a solid-state switching relay to be readily mounted directly in place of the conventional contactor.

Generally, in accordance with the present invention, the housing assembly includes opposed similar end housing components or sections including inwardly projecting and aligned sidewalls. A shallow intermediate wall section is interposed between the opposed or opposite end sections. Contact boards are provided with a plurality of contact means secured along the vertical edge or one side edge. The boards are disposed between the end sections and intermediate wall section with the contact means forming an interlock between the several elements to firmly support the mounting boards between the sidewalls of the end sections and the intermediate wall section. The circuit components are mounted to the circuit boards facing the end section and the circuit connections may be made to the opposite side of the board. The intermediate wall section defines sufficient spacing between the circuit connections of the two boards and the depth of the sidewall defines a housing or a chamber within which the components are enclosed. The end sections and the intermediate wall section are preferably formed with complementing and corresponding downwardly projecting leg sections. A U-shaped mounting bracket similar to that employed in the conventional contactor is telescoped over the leg portions with the bracket base formed in accordance with the usual mounting bracket construction. The sidewalls of the bracket close the opposite ends of the opening defined by the depending legs of the housing and thus defines a generally enclosed chamber. Solid-state components which particularly require maximum cooling may advantageously be mounted to the base of the metal bracket and thus provide direct heat conduction between the metal bracket and the mounting wall. Furthermore, the base of the mounting bracket may be formed with an inwardly offset portion to facilitate mounting of the solid-state components and the like to the mounting bracket.

The drawing furnished herewith illustrates the best mode presently contemplated by the inventor for carrying out the subject invention in which the above advantages and features are clearly disclosed as well as others which will be clear from the description of such drawing.

In the drawing:

FIG. 1 is a pictorial view of a solid-state switching assembly constructed in accordance with the present invention;

FIG. 2 is an exploded pictorial view of the assembly shown in FIG. 1;

FIG. 3 is a vertical section taken generally on line 3-3 of FIG. 1 with parts broken away and sectioned more to clearly illustrate the construction shown in FIGS. 1 and 2.

Referring to the drawing and particularly to FIG. 1, the illustrated embodiment of the invention is generally a rectangular boxlike solid-state relay unit having an outer insulating housing assembly secured within a U-shaped mounting bracket 2.

The housing assembly 1 extends outwardly from the bracket 2 and includes a series of aligned side-by-side contacts or connectors 3 and 4 extending along the sidewalls of the housing assembly 1. The portion of the housing within the bracket 2 is inset laterally to define recesses and the base 6 of bracket 2 is provided with suitable mounting openings 5 in accordance with bracket mounting construction presently employed with electromagnetic contactors. The illustrated housing assembly 1 thus defines a rectangular unit corresponding to the general configuration of an electromagnetic contactor widely employed in the electrical industry and the mounting bracket essentially is identical to that employed in the industry with the mounting openings 5 providing for direct replacement of the conventional electromagnetic relay with the unit such as shown in FIG. 1.

Referring particularly to FIGS. 2 and 3, the housing assembly 1 includes similar opposed end sections 7 and 8 separated by an intermediate or central dividing wall section 9. A circuit board 10 is mounted between the end section 7 and the intermediate wall section 9 with the electrical circuitry carried by the board interconnected into circuit through the contacts or connectors 3. A circuit board 11 is similarly disposed between the end section 8 and the wall section 9 with the circuit connections made by the connectors 4 to the opposite side of the housing assembly 1. The several end sections 7 and 8 and the wall section 9 are interconnected to each other through suitable connecting means such as rivets 12 to form a unitized construction such as shown in FIG. 1 which completely encloses the circuit boards 10 and 11 except for the exposed portions of connectors 3 and 4. The boards 10 and 11 are thus completely enclosed in a suitable insulating outer housing.

The end sections 7 and 8 are similarly constructed as complementing members and consequently the end section 8 is described in detail with corresponding components or portions of end sections 7 generally identified by similar primed numbers for simplicity and clarity of explanation.

Referring particularly to FIGS. 2 and 3, the end section 8 includes a solid rectangular end wall 13 of approximately two-thirds of the complete height of the housing assembly 1. It is formed of a suitable insulating material, such as a molded nylon and in the illustrated embodiment of the invention is integrally formed with a shallow top wall 14, similar sidewalls 15 and 16 and a bottom wall 17. Depending legs 18 extend downwardly from below the bottom wall 17 and spaced inwardly from the outermost plane of the sidewalls 15 and 16.

The sidewalls 15 and 16 are similarly formed as a plurality of connected inwardly opening V-shaped recessed portions defining a slotted upper connection wall 19 which face upwardly and outwardly at an angle along the sidewalls. Each of the walls 19 includes an edge slot 20 defining an opening to accommodate the related connector 4.

The circuit board 11 is illustrated as a more or less conventional rectangular printed circuit board member which is slightly smaller than the rectangular configuration, defined by the top, bottom and sidewalls of the end section 8. L-shaped connecting lugs 21 are secured along the opposite sidewalls in spaced relation with corresponds to the spacing of the slotted connecting walls 19. The base of each of the lugs 21 is secured immediately adjacent to the edge of the board 11 as by a rivet 22 to provide physical mounting and circuit connection to the circuit of the board 11. The lug 21 extends upwardly and laterally outwardly generally in the plane of the back side of the board 11. The outer end of the L-shaped lug 21 projects over the board into alignment with the slotted wall 19. The length of the projecting leg is generally somewhat less than the length of the sidewall 16 and is provided with a bolt or screw opening 23 in alignment with the slot 20.

The connector 4 includes a connecting screw 24 which passes through a flat bracket 25 and threaded into a corresponding opening of the lug 21. The flat bracket 25 is preferably provided with parallel stamped ridges for terminating of bare stranded wire by crimping thereof as the screw 24

is tightened down and forces the ridges against the lug 21. The flat bracket 25 may be provided along the one edge with an upstanding tab 26 to receive a bayonet-type lugged wire connector 27 for making a solderless slip-on connection.

The circuit components 28 are interconnected and mounted to the boards 10 and 11 and in particular to the side of the board facing the end section as shown. Printed circuit connections 29 are provided on the back side of the board with the connections made through suitable openings in the board in accordance with the usual printed board construction. In the illustrated embodiment of the invention, the boards are provided with a common B plus line 30 and a common ground or reference line 31 secured to the bottom edge of the board 11 and interconnected through the printed circuit connections 29 to provide for the input output circuit connections between the two boards.

The board 11 is secured and mounted within the housing assembly 1 through cooperative clamping engagement between the end sections and the intermediate or dividing wall section 9.

The intermediate wall section 9 is generally a rectangular ring member having top and bottom sidewalls located in alignment with the corresponding walls of the end sections 7 and 8. The wall 9 further includes depending legs 32 aligned with the depending legs 18 of the end sections 7 and 8 to maintain, in the assembled relations of, a continuous and closed sidewall construction except for the exposure of the connectors 3 and 4.

The opposite faces of the wall section 9 include similar shallow stepped recesses 33 complementing the positioning of the lugs 21 in the sidewall housing, and the clamping ends or edges of the adjacent end section 7 or 8. In the assembled relation, the outwardly extending portion or back side of the lugs 21 mate with the base of the recesses 33. The end edges of the end sections 7 and 8 abut the lugs 21 to firmly clamp the circuit boards between the respective end sections 7 and 8 and the intermediate wall section 9. For example, as shown in FIG. 3, the centrally illustrated lug 21 mates with a recess 33 which includes a locating ledge 34 the vertical face of which will abut the end edge of section 7, which is broken away in FIG. 3. This construction provides a very simple, inexpensive and reliable means of mounting of the circuit boards as a total part of the housing with the printed board connection 29 spaced by the intermediate wall section 9 and the circuit components 28 mounted and housed within the chambers defined by the end sections 7 and 8. In the illustrated embodiment of the invention, the assembly is clamped by rivet 12 which extends respectively through suitable openings 35 in the top wall of the respective elements and corner openings 36 in the bottom corner portions aligned with the corresponding bottom walls 17 and 17' of the several housing sections 7, 8 and 9.

The U-shaped bracket 2 includes the sidewalls 37 of a width generally corresponding to the width of the end wall 13 with the sidewalls 37 generally spaced in accordance with the total depth defined by the assembled sections 7-9 such that the bracket telescopes over the unit to close the opposite or lower end between the depending legs 18 and 18'. The bracket sidewalls 37 extend upwardly into alignment with the bottom corner openings 36 and are provided with corresponding openings to provide a firm interconnection to the housing assembly by rivet units 12.

The base portion 6 of bracket 2 may be provided with an inwardly upset portion 38 defining an apertured base for mounting of temperature sensitive elements or the like which are interconnected into the circuit through the circuit boards. The U-shaped bracket 2 thus not only provides a convenient mounting means, but may provide a heat sink for the temperature sensitive solid-state components such as controlled rectifiers which are presently widely employed in static switching systems.

In the assembly, the circuit components and circuit connections are made to the several boards 10 and 11. The boards 10 and 11 with the connecting lugs 21 are then assembled with

the housing sections 7 and 8 and the central wall section 9 and finally interconnected through the U-shaped mounting bracket. As previously noted, the bracket 2 in the illustrated embodiment of the invention may correspond to those generally employed in connection with electromagnetic relays and thereby permit substitution of a solid-state static switching module for the conventional electromagnetic unit.

The intermediate wall section 9 and the clamping of the boards 10 and 11 as shown establish the plurality of side-by-side terminals which are readily and conveniently available while electrically isolated. The L-shaped connecting lugs provide a convenient means of obtaining a direct and simple termination of the terminals. They are particularly adapted to printed circuit board technique where the single riveting operation provides a simultaneous mounting and termination of the connecting terminal. The present invention thus provides an economical and versatile circuit component housing which is particularly adapted to a solid-state switching application.

I claim:

1. An electrical housing assembly having a pair of adjacent circuit connecting chamber means, comprising a pair of opposed end housing sections and an intermediate divider wall section secured in stacked relation, said end housing sections each one having a pair of similar shallow sidewalls extending inwardly toward the opposite end housing section and including a plurality of connector means positions along at least one sidewall, a pair of circuit board means one each between the divider wall section and the corresponding end section and having terminal means extending outwardly and then laterally in overlapping relationship with the corresponding sidewall and in alignment with said connector means positions, and means to interconnect said housing sections and wall section in abutting relation with said circuit board means clamped to the corresponding sections.

2. The electrical housing assembly of claim 1 wherein said similar shallow sidewalls include a plurality of adjacent inclined wall portions defining said connector means positions and said terminal means include conducting members abutting said inclined wall positions.

3. The electrical housing assembly of claim 2 wherein said divider wall section is essentially a ring member having end faces, each of said sidewalls abuts the end face of the divider wall section and said sidewalls are recessed to correspond to the abutting sidewalls of said end housing sections.

4. The electrical housing assembly of claim 1 wherein said end housing section have a generally rectangular base with top and bottom walls and said similar shallow sidewalls extend perpendicularly from the base and terminating in a common plane, said sidewalls including a plurality of V-shaped recesses defining connector wall portions along the sidewalls, said circuit board means being generally flat rectangular boards clamped between the divider wall section and the end section and having said terminal means interlocked with the corresponding sidewall whereby interconnection of the end sections and the divider wall section supports said boards.

5. The electrical housing assembly of claim 1 wherein said terminal means include conducting strips abutting said sidewalls and said sidewalls being formed with interlocking projecting walls adjacent to the edges of said strips to provide physical positioning and supporting of said strips.

6. The housing of claim 1 wherein said end housing sections and said divider wall section define a generally closed rectangular housing, the sidewalls of the end sections being similarly formed to define a series of vertically spaced recesses having upwardly facing apertured inclined wall portions defining said connector mean positions, said divider wall section having the opposite end faces abutting said sidewalls recessed in accordance with said spaced recesses, said circuit board means including rectangular boards fitting within the inner edges of the end sections and having L-shaped connectors secured to the vertical edges with one leg in the plane of the board and clamped between the face of the divider wall section and the

edge of the adjacent end section and having an outer leg abutting said inclined wall portions, and releasable circuit connecting means adjustably attached to the outer leg of the connectors.

7. The housing of claim 6 having a pair of downwardly extending sidewall legs secured to the bottom of the end sections, a U-shaped metal mounting bracket having sidewalls spaced in accordance with the width to said end housing and telescoped with the sidewall legs to define a chamber beneath the circuit connecting chamber.

8. The housing of claim 1 wherein said end housing sections and said divider wall section define a generally closed rectangular housing having a pair of downwardly extending sidewall legs, a U-shaped metal mounting bracket having brackets corresponding in width to said end housing and spaced to telescope with the sidewall legs to define a chamber beneath the circuit connecting chamber.

9. The electrical housing assembly of claim 1 wherein said terminal means include strip portions overlying and abutting

the exterior surface of the sidewalls and having clamp connector means overlying said terminal means and the corresponding strip portions and including a screw means passing through a generally flat clamping bracket and into the corresponding strip portion of the terminal means, said bracket having clamping ridges projecting downwardly toward the terminal means.

10. The electrical housing assembly of claim 1 wherein said terminal means include strip portions overlying and abutting the exterior surface of the sidewalls and having clamp connector means overlying said terminal means and the corresponding connection means positions of the sidewalls and including a screw means passing through a generally flat clamping bracket and into the corresponding strip portion of the terminal means, said bracket having an outwardly projecting tab for receiving a slip-on connection means for establishing a solderless, releasable connection.

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