

PATENT SPECIFICATION (11)

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(54) HEAT DISSIPATION ARRANGEMENTS FOR PRINTED CIRCUIT BOARDS

(71) We, THE PLESSEY COMPANY LIMITED, a British Company of Vicarage Lane, Ilford, Essex IG1 4AQ, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electrical or electronic equipment mounted on component mounting boards such as printed circuit boards and is more particularly concerned with heat dissipation arrangements for use with printed circuit boards carrying integrated circuit components and the like.

According to the invention there is provided heat dissipation equipment for incorporation with electrical component mounting boards, the equipment comprising one or more heat conducting plates arranged in thermal contact with the electrical components on the board and a heat exchanger arranged in thermal contact with the plate or plates the exchanger being located outside the plane of the mounting board and including a cooling fluid circulation channel and in which the plate or plates are bonded to the component mounting face of the component mounting board.

Preferably the heat exchanger includes a fin arrangement incorporating louvred fins and it is adapted for use with convected air for cooling of a printed circuit card.

According to a feature of the invention arrangements are provided for ensuring that the printed circuit boards are mounted in rows and columns in an equipment rack and all the heat exchangers of all printed circuit cards mounted in a vertical column of the equipment rack co-operate with each other and are arranged substantially in vertical alignment, and the equipment rack includes means for forcing air through the tunnels formed by the co-operating heat exchangers.

The invention together with its various features should be understood from the accompanying description of one embodiment shown in the accompanying drawings. Of the drawings:—

Fig. 1 shows a side elevation view of a

printed circuit card incorporating heat exchanger in accordance with the invention.

Fig. 2 shows a plan view of the printed circuit card incorporating an embodiment of the invention.

Fig. 3 shows a cut-away three-dimensional diagram of a heat exchanger element, whereas

Fig. 4 shows in schematic form the arrangements of a number of printed circuit cards in an equipment rack.

Referring firstly to Figs. 1 and 2 it will be seen that the embodiment of the invention comprises a printed circuit card 1 upon which integrated circuit components such as ML1 to ML 45 are located together with a heat exchanger 2 fastened to the printed circuit board at the edge remote from edge-connector edge 3. Typically the heat exchanger element 2 is connected to the printed circuit card by way of nuts and bolts referenced 4 in Figs. 1 and 2. On the component mounting side of the printed circuit board 1 is a plate 5 to which the heat exchanger 2 is thermally connected. The plate 5 comprises an aluminium sheet in which holes are drilled or etched to accommodate the connection leads for the integrated circuit components. In assembling the printed circuit board equipment the components have their connecting leads inserted through the holes in the aluminium sheet which have corresponding holes in the printed circuit board and the body of the electrical component is thermally bonded to the aluminium plate 5. The finned heat exchanger 2 is shown in more detail in Fig. 3 and this element is used to provide an extension of the plate 5 so that it may be cooled and therefore cool the plate 5 by air passing through the fins. The heat exchanger 2 is made of thick aluminium and it is folded to form a box-like structure with internal veins 7. This arrangement ensures that the maximum contact area of the exchanger envelope is exposed to the cooling fluid (air). In addition the veins 7 are louvred to increase the effectiveness of the air circulation in the exchanger.

In operation the printed circuit cards are mounted vertically so that air is forced 100

vertically up the heat exchanger 2. Reference to Fig. 4 shows a number of shelves of printed circuit cards mounted one above the other. Also incorporated in the equipment rack is a fan 8 which causes air convection through the tunnels created by the heat exchangers which for each shelf are aligned in a vertical manner.

Alternative configurations of heat exchanger should readily be appreciated by those skilled in the art and indeed alternative ways of bonding the heat exchanger to the component mounting heat conducting plate can readily be seen. Further, whilst the plate 5 has been described as being a single plate on which all components are mounted, alternative arrangements incorporating "bus-bars" for each horizontal row of components arranged such that a row of components is only bonded to the "bus-bars" located immediately below it could be provided.

WHAT WE CLAIM IS:—

1. Heat dissipation equipment for incorporation with electrical component mounting boards, the equipment comprising one or more heat conducting plates arranged in thermal contact with the electrical components on the board and a heat exchanger arranged in thermal contact with the plate or plates the exchanger being located outside the plane of the mounting board and including a cooling fluid circulation channel and in which the plate or plates are bonded to the component mounting face of the component mounting board.

2. Heat dissipation equipment according to claim 1 in which the component mounting board is a printed circuit board and the heat exchanger is located at the edge of the printed circuit board remote from the edge connector thereof.

3. Heat dissipation equipment according to claim 1 or 2 and in which the heat exchanger is made of heat conducting material formed into an open ended box incorporating folded fins.

4. Heat dissipation equipment according to claim 3 in which the fins are louvred.

5. An electrical equipment mounting rack comprising a plurality of vertically mounted shelves each including a plurality of printed circuit boards incorporating heat dissipation equipment according to any preceding claim the boards being mounted rows and columns and in such a manner that the heat exchangers of all printed circuit boards mounted in a vertical column of the rack cooperate with each other and are arranged in vertical alignment.

6. An electrical equipment mounting rack as claimed in claim 5 in which a fan is mounted on the rack to produce a convected air flow through the vertically aligned heat exchangers.

7. Heat dissipation equipment substantially as herein described with reference to the accompanying drawings.

8. An electrical equipment mounting rack substantially as herein described with reference to Fig. 4 of the drawings.

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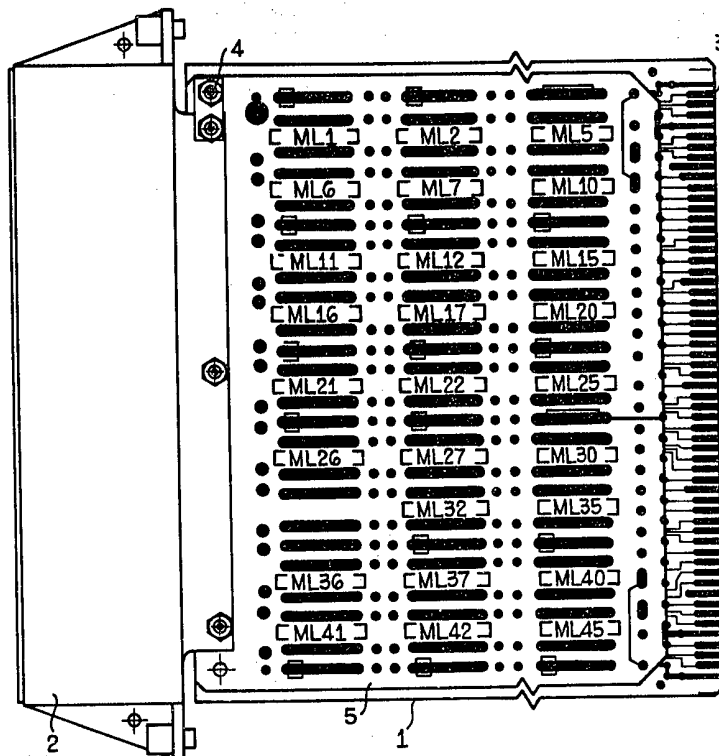


Fig. 1

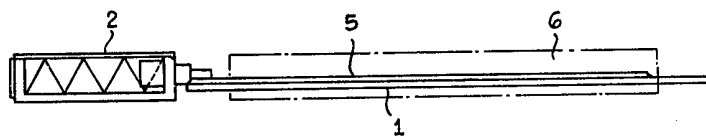


Fig. 2

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COMPLETE SPECIFICATION

3 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale
Sheet 2*

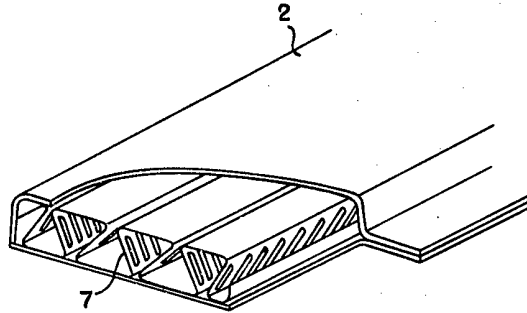


Fig. 3

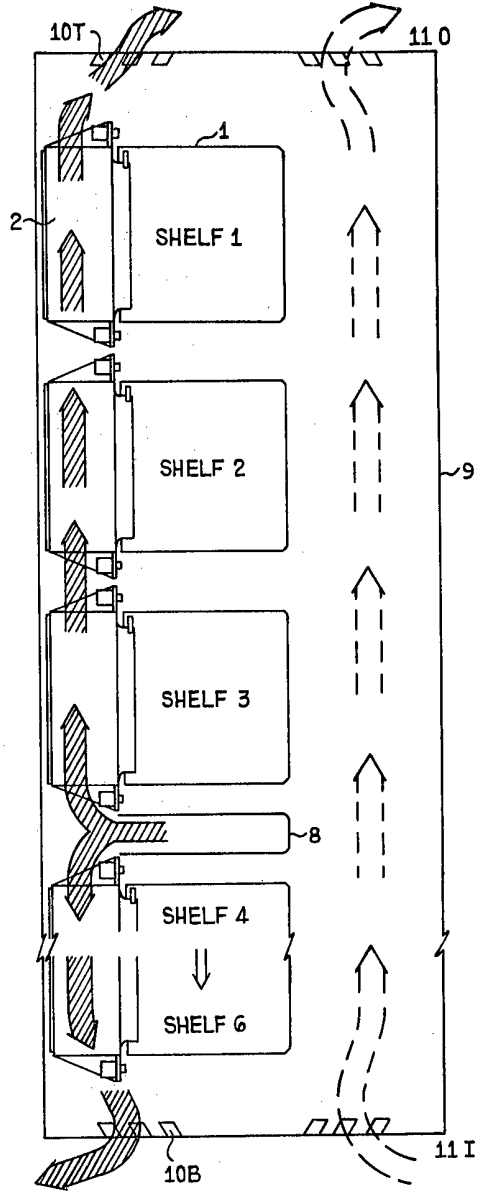


Fig. 4