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A Circuit Board Assembly

The present invention is with respect to a circuit board assembly, and more specially to such a board assembly having a board body fitted with electrical components and fluid controlling or controlled components (herein named "fluid components") and with a connector having in-line electrical and fluid terminals pointing in a common direction.

Such circuit boards may be used for electrical-pneumatic controls with a board member in the form of a printed circuit board fitted with the electrical components. Furthermore the fluid components, as for example solenoids, and pneumatic plug terminals, are screwed on the circuit board. By pushing the circuit card or board into a part of an apparatus designed therefor and having electrical plug contact terminals for functioning with the electrical plug contact terminals on an edge of the circuit board, it is possible for the electrical and fluid connections to and from the circuit board to be produced.

For joining up the fluid components with the fluid terminals on the circuit card, and for joining them with each other, flexible pipe connections have been so far used in the art, whose ends are slipped over nozzles of the fluid terminals or of the fluid components as the case may be.

The putting together of the fluid components on such a prior art design of circuit card is for this reason likely to be very slow work. Furthermore the different pieces of connection pipe will be sticking out from the circuit card so that the cards have to be fixed in place well clear of each other to make certain that there is no

chance of any of the connection pipes being pulled off by chance on plugging a circuit card in place.

One purpose or object of the present invention is that of so designing a circuit board or card of the sort noted hereinbefore that the fluid components may be fixed in place more simply thereon.

A still further purpose of the invention is making it possible for a number of such cards of the sort in question to be placed nearer to each other without any danger of damaging the ducts means of such a board or card.

According to the present invention there is provided a circuit board assembly comprising a board body, electrical components and fluid components fitted on the board body, and electrical and fluid plug terminals extending in the same direction to have a common direction of plugging, a plurality of ducts being formed within the board body with each of the ducts communicating between one of the fluid terminals and a port placed in a component mounting face on the board body.

The different fluid ducts are made part of the board member so that the same may be looked upon as having the function of a sort of circuit board made with a duct connection system that is much like the printed wiring of a printed circuit board but is different thereto only inasfar as it has a fluid conducting and switching function in place of an electrical one, on which the fluid components only have to be mounted, something that may be done quite simply, it being possible for the desired fluid connections between a given component and the terminals to be made on the component mounting face without any connection hoses being needed.

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The system of connections of the different ducts may be fixed right from the time the circuit board is produced without any chance of them being changed or positioned in error later. Furthermore the ducts take up very little space and are well safeguarded right inside the card or board member. In practice more than 50% less space is needed.

As part of one possible development of the invention, the board is in the form of a laminated structure with at least two board members, the inner connection ducts are in the form of channels in the interface between one board and the other or next board and the channels are joined up, by way of through holes in the boards, with the said mounting face, such through holes having a direction component normal to the plane of the board.

This makes it possible for simple molds to be used for manufacturing the different single board members with a number of different ducts in different planes of the board body.

The board member may be made of hard foam material, at least in the part thereof forming the component mounting face. This makes it very simple for the fluid components to be sealed on the said face simply by placing them in contact therewith inasfar as the hard foam material will be somewhat bent thereby and a fluid tight join will be produced. Furthermore, if such hard foam material is used, the fluid components may be fixed directly on the mounting face by using screws, as for example self-tapping ones, for which pilot holes will have been drilled in the board beforehand.

It is possible for the board member and the fluid components to have plug terminals, working together with each other, thereon and

having a plugging direction normal to the said mounting face. This then makes it possible for the separate fluid components, that have electrical control terminals thereon, to be positioned on the component mounting face in a single plugging operation and the fluid connections will then all be produced at the same time. When they are so put into position the components will be kept firstly in place by the electrical terminals for the time being till they are then able to be fixed in position by fastening means such as screws. Such screwing in position is in fact made simpler because of the supporting effect of the electrical terminals.

The plug terminals of the fluid components may extend laterally outwardly of the components themselves while the fixed plug terminals are placed on the board member the right distance to the side clear of the positions of mounting of the components. This makes it possible to see that the electrical connection wires and the fluid connection ducts are kept separate from each other, this being of value in connection with simple assembly and production and furthermore when it comes to looking for errors in the system.

The board may furthermore have first positive locking means functioning with second matching positive locking means as part of a circuit board housing. Such a housing may have at least one mounting position for a further such circuit board. The housing may have further locking means on its outer side for use with matching positive locking means in a hollow of the housing.

Such further developments of the design are generally to make it simpler for a single circuit board or a number of such circuit boards to be put in place in a hollow or socket.

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In fact, when the housing is made with the further mounting position for a further circuit board, one such board having mostly electrical components may be housed in the housing in addition to a circuit board mainly fitted with fluid components, the two boards then functioning as single unit, this making it specially simple to come across any errors or damage, if present and boards that are no longer in working order may be simply replaced.

An account will now be given of one working example of the invention using the accompanying figures.

Figure 1 is an end-on view of a circuit board having electrical and fluid controlling components therein, looking in the direction of plugging.

Figure 2 is a view looking down on the circuit board or card of figure 1.

Figure 3 is a view from the side of the circuit card to be seen in figures 1 and 2.

Figure 4 is a cross-section through the circuit card of the figures 1 to 3.

In the figures the reader will see a circuit board generally numbered 10, that is slidingly taken up in a housing 12, whose one half is to be seen broken away in the figure.

The circuit board 10 is made up of three board members 14, 16 and 18 placed flatwise on top of each other. The board members are made of hard foam material and are joined together by adhesive, for example. In the face or interface, to be seen on the right in figure 4, of the board member 16 surface channels 20-0 to 20-9 are formed, each of same opening at one end into an outlet or power port 22 in a free face, forming a component mounting face 24, of the board member 18. The other ends of the fluid ducts in the form of the surface channels 20 shut off on their otherwise open sides by the board member 14 are each joined up with a different one of ten fluid

plug terminals or spigots 26-0 to 26-9, supported and forming part of an in-line terminal assembly 28.

Furthermore there are ten inlet ports 30 opening at the component mounting face 24 and they are joined up by way of surface channels 32 in the side face, to be seen on the right in figure 4, of the board member 18 with a further channel 34, running in the length direction of the board 18. The channel 34 together with the limiting face of the board member 16 to be seen on the left in figure 4 makes up an inlet duct that is joined up with a plug terminal 36 for the supply of fluid under pressure, the terminal 36 being joined up with the in-line terminal assembly 28.

The different channels are placed symmetrically in relation to the lengthways middle plane of the board members 14, 16 and 18 so that on each side of the said middle lengthways plane there are five mounting positions or points for fluid components. In the present working example these components are taken to be 2/2 solenoid valves 38-0 to 38-9.

The solenoid valves 38 are kept in place directly on the assembly made up of the boards 14 to 18 by way of self tapping screws 40 so that the inlet and outlet ports of the valves, placed in the surface next to the board assembly, are air-tightly joined up with the outlet and inlet ports 30 and 22.

In their side face next to the middle of the circuit board the solenoid valves 39 in each case have two electrical knife contact terminals 42 (figure 4) plugged in between contact springs 44 therefor. The contact springs 44 are so designed that the solenoid valves may be moved in a direction normal to the plane of figure 2 towards the mounting face 24, the knife contacts 42 then automatically taking up positions between the contact springs 44 when such mounting motion takes place. In this way the solenoid valves 38 are kept in place even before driving home the screws so that the

screwing operation is in fact made simpler.

Each of the contact springs 44 has a soldering lug 46 formed thereon for connection with electrical wiring.

The contact springs 44 are positioned in a plug housing 48 by molding, that is to say locked in place by molding the resin of the housing 48 round them. The housing 48 is seated on a fin 50 running along the board 18 in the length direction thereon. The housing 48 has slots 52, through which the knife contacts 42 may be freely moved into position. The complete assembly made up of the contact springs 44 is shut off by a cover 54, that for its part is fixed on the plug housing 48 by way of screws 56. The different electrical conductors running to the contact springs 44 are joined up with an electrical plug connector 58 with a cable 60.

As may be more specially seen from figure 4, the board 14 has side wings 62 that are locked into dovetail grooves 64 in the housing 12. To keep the circuit board 10 locked in the housing 12 there are sprags 66 (see figure 2) acting as locking means, that are screwed in place by screws 68 on the in-line terminal assembly 28 and take effect on the housing 12.

As the reader will more specially be able to see from figures 3 and 4, the housing 12 is so large in size that there there is still room in it for a second circuit board. This circuit board may be designed on the same lines as the circuit board 10, or it may be fitted with mostly electronic components for controlling the different solenoid valves 38.

As will be seen from the figures, the housing 12 has dove-tail section slots 64 on its inner side, while its outer faces are ribbed at 70 so that the unit made up of the circuit boards and the housing 12 may slipped into an enclosure therefor.

At its end 12 the housing 12 may be shut off by a cover (not to be seen in the figures) kept in place by adhesive or by a snap-on

locking system so that the housing 12 and the circuit boards as a unit placed therein positioned therein are safeguarded against dust and moisture.

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Claims :-

1. A circuit board assembly comprising a board body, electrical components and fluid components fitted on the board body, and electrical and fluid plug terminals extending in the same direction to have a common direction of plugging, a plurality of ducts being formed within the board body with each of the ducts communicating between one of the fluid terminals and a port placed in a component mounting face on the board body.

2. A circuit board assembly according to claim 1, wherein the board body is formed of at least two board members joined flatwise together, the ducts being in the form of channels in at least one of the board members with sides of the ducts covered over by the adjacent board member, and the ducts communicating with the component mounting face by means of holes extending through the board members, the holes having a part extending normal to the component mounting face.

3. A circuit board assembly according to claim 1 or 2, wherein the board body, at least in a part thereof having the component mounting face thereon, is made of hard foamed synthetic resin.

4. A circuit board assembly according to any of claims 1 to 3, comprising co-operable plug terminals on the board body and on the fluid components, the terminals being connected together by movement in a direction normal to the component mounting face.

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5. A circuit board assembly according to claim 4, wherein the plug terminals of the fluid components project laterally thereof over the board body and the plug terminals of the board body are located thereon at the respective side of component mounting positions on the component mounting face.

6. A circuit board assembly according to claim 5, wherein the plug terminals of the board body are placed in line with each other.

7. A circuit board assembly according to any of the preceding claims, comprising a housing, first positive locking means and second locking means on the housing for functioning with the first locking means.

8. A circuit board assembly according to claim 7, wherein the board body is placed in the housing, the latter being designed to take up at least one further such board.

9. A circuit board assembly according to claim 8, having further positive locking means on an outer side of the housing, and a housing enclosure for the housing, the enclosure having matching locking means thereon for use with the positive locking means on said outer side.

10. A circuit board substantially as described hereinbefore with reference to the accompanying drawings.