

April 28, 1964

M. A. MITTLER
EDGE BOARD CONNECTOR

3,131,017

Filed April 20, 1961

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FIG. 1

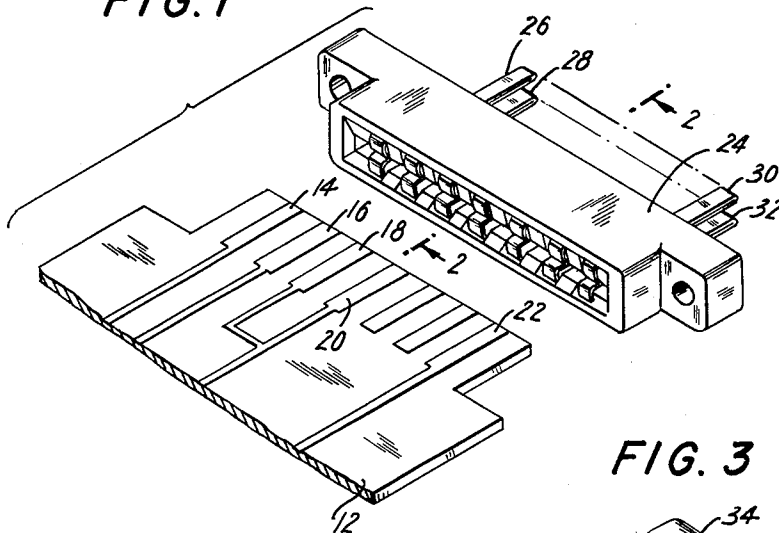


FIG. 2

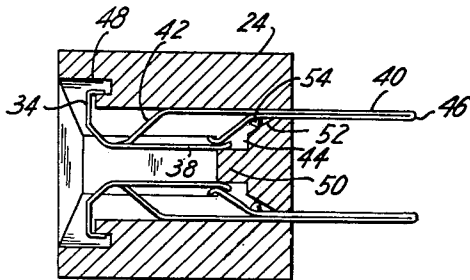


FIG. 3

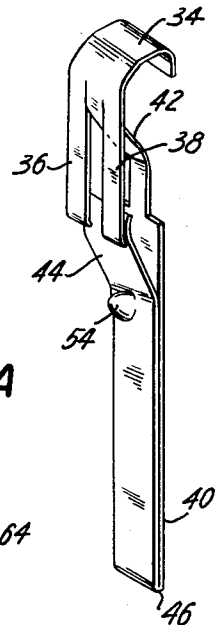


FIG. 3A

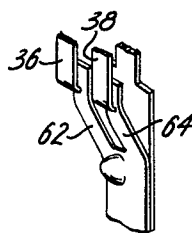


FIG. 4

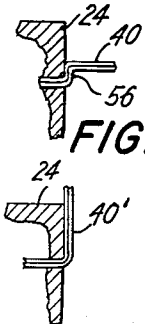


FIG. 5

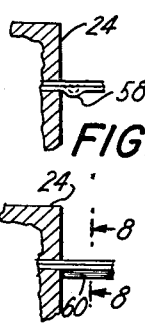


FIG. 6

FIG. 7

FIG. 8

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FIG. 9

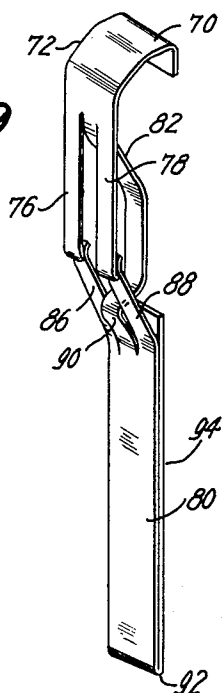


FIG. 10

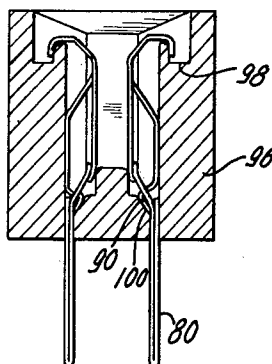


FIG. 12

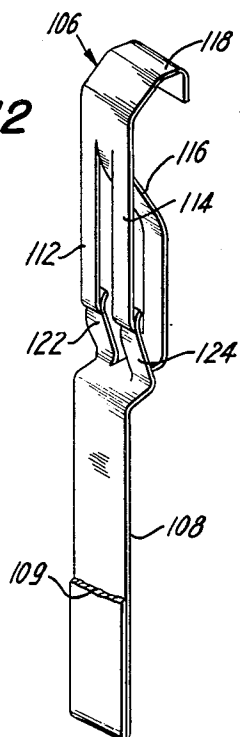
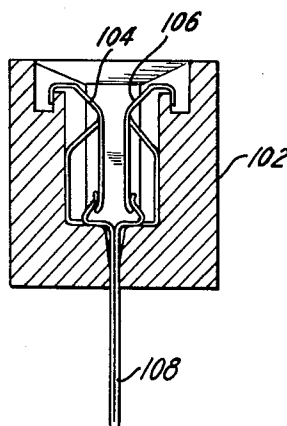


FIG. 11



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3,131,017

EDGE BOARD CONNECTOR

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12 Claims. (Cl. 339-259)

This invention relates to detachable connectors, and more particularly to a connector which slidably receives the edge of a printed circuit board.

The general object of the present invention is to improve detachable connectors, especially edge board connectors.

There are devices which employ interchangeable units based on a printed circuit board, sometimes called "cards." In recent years there have come into use female connectors with resilient contacts, and printed lines on the board engage the resilient contacts for electrical connection thereto.

One object of the present invention is to provide a resilient contact with relatively long wiper surfaces. Another object is to provide a large area of contact with the printed circuit lines. A further object is to provide spaced independent wipers on each contact, thereby better insuring good electrical contact. A still further object of the invention is to provide a short direct current flow path from the wiper through the contact.

To accomplish the foregoing objects, and other more specific objects which will hereinafter appear, my invention resides in the contact elements and their relation one to another as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

FIG. 1 is a perspective view showing how the edge of a printed circuit board is received in a connector;

FIG. 2 is a transverse section through the connector, taken approximately in the plane of the line 2-2 of FIG. 1;

FIG. 3 is a perspective view showing a resilient contact embodying features of my invention;

FIG. 3A is a fragmentary view of a modification;

FIGS. 4 through 8 show variant ways in which the contact may be anchored against removal from the insulation body of the connector;

FIG. 9 is a perspective view like FIG. 3, but showing a different form of the invention;

FIG. 10 is a transverse section through a connector, like FIG. 2, but utilizing the contacts of FIG. 9;

FIG. 11 is a transverse section through an edge board connector utilizing a double contact with a common or single tail; and

FIG. 12 is a perspective view of the right-hand half of the double contact shown in FIG. 11.

Referring to the drawing, and more particularly to FIG. 1, a printed circuit board has an edge portion 12 with printed circuit lines terminating in contact areas 14, 16, 18, 20 and 22. This board may be slidably received between the resilient contacts of an edge board connector 24. The tails of a few end contacts are shown at 26, 28, 30 and 32, but it will be understood that there are tails for all of the contacts therebetween.

Referring now to FIGS. 2 and 3 of the drawing, the contact comprises a ribbon of resilient metal shaped to

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form a sloping hook 34 at its upper end, with a spaced pair of elongated parallel wipers 36 and 38 depending therefrom. A tail or soldering lug 40 is disposed beneath and generally parallel to but offset from the wipers. An upper cantilever leaf spring 42 is an integral continuation of the hook 34 and the tail 40. This upper spring is formed of material sheared from between the spaced wipers 36 and 38. There is also a lower cantilever leaf spring 44 between the tail 40 and the lower ends of the wipers 36 and 38.

From inspection of FIGS. 2 and 3 it will be seen that a wiper is relatively long, yet when displaced it maintains parallelism because it is supported by separate leaf springs at both ends. The use of two separated wipers 36 and 38 has the further advantage that one wiper usually makes good contact even when the other does not.

In FIGS. 2 and 3 the tail is reversely folded at its lower end 46, and the spring 44 is formed out of the material at the upper end of the reversely folded tail. The double thickness is desirable in order to give body and strength to the tail.

The minimum spacing between opposed contacts is determined by the design of the molded insulation body 24. As shown in FIG. 2 this body has pockets 48 to receive the hooks 34, and to permit outward or spreading movement of the same. There is also a spacer 50 which helps support the lower ends of the wipers. The dimension of these parts depends on the thickness of the printed circuit board or card to be received. An abutment 52 helps hold the contact against movement through the body 24, and this anchorage may be strengthened by the provision of a protuberance 54 struck from the contact.

In FIGS. 2 and 3 the contact has not yet been anchored against removal from the insulation body. Such anchorage may be provided in many ways, some of which are illustrated. In FIG. 4 the tail 40 has been stepped sidewardly or offset at 56. In FIG. 5 a dot or teat 58 has been struck inwardly just below the casting or body 24. In FIG. 6 the tail has been bent sideward as shown at 40'. This may be done when the connector is itself to be permanently soldered to one face of a printed circuit board, in addition to receiving detachable boards or cards edgewise as shown in FIG. 1. In FIGS. 7 and 8 the tail has been longitudinally indented or deformed to V or trough shape, as shown at 60, thereby anchoring the contact against removal from the insulation base.

It has already been mentioned that an advantage of using two spaced wipers 36 and 38 (FIG. 3) is the possibility of independent self-adjustment. To enhance this, the lower spring 44 may be divided to form two spaced parallel springs which are independent of one another, as shown at 62 and 64 of FIG. 3A. The spring 62 bears against and controls only the wiper 36, and the spring 64 bears against and controls only the wiper 38.

Another form of contact embodying features of my invention is illustrated in FIGS. 9 and 10 of the drawing. Here again the contact comprises a ribbon of resilient metal shaped to form a single thickness hook 70 at its upper end. This hook includes a sloping portion 72 which, as before, facilitates reception or insertion of the card or printed circuit board. There are a spaced pair of elongated parallel wipers 76 and 78 depending from hook 70, and a tail 80 is disposed beneath the wipers. The tail is preferably parallel to, but offset from the

wipers. An upper cantilever spring **82** constitutes an integral continuation of the hook **70** and the tail **80**, and it is formed of metal sheared from between the spaced wipers **76** and **78**.

There are also two spaced parallel lower springs **86** and **88** which bear respectively and independently against the lower ends of the wipers **76** and **78**. In this case there is material sheared from between the springs **86** and **88** as well as from between the wipers **76** and **78**, and this material forms not only the upper spring **82**, but also a reversely folded locating stop **90** at the upper end of the tail **80**. The tail is reversely folded at **92** to provide a double thickness at **94**. It will be seen that this contact could function with a single thickness tail terminating at **92**, but the double thickness is preferred in order to add thickness and strength to the tail.

FIG. 10 shows the contacts of FIG. 9 mounted in an insulation body or base **96**. This base is substantially the same as that illustrated in FIG. 2, and the hooks at the upper ends of the contacts are similarly received in appropriate pockets **98**, while the locating stops **90** bear against mating parts **100** of the casting.

As so far described the printed circuit board or card is received between opposed contacts which are insulated from one another, and which make possible separate electrical connection to printed lines on either side of the board. In some cases the lines on one side may be offset from and never coincident with the lines on the other side, and in some cases opposed lines on both sides may be common. In such cases the opposed spring contacts may be electrically connected together, and may have a common tail. Such a connector is shown in FIG. 11, in which the insulation base **102** receives a series of double contacts. Each double contact comprises yieldable left and right sides **104** and **106** formed respectively at the upper ends of a single reversely folded tail **108**. The double contact is shown in perspective in FIG. 12, but in order to simplify the drawing only the right side **106** is shown, the left side being broken away at **109** to more clearly expose the right side. However the contact is symmetrical, and a description of the right side will suffice for the left side as well.

The side **106** has spaced parallel wipers **112** and **114**. They are supported by an upper cantilever spring **116** which constitutes an integral continuation of hook **118** and tail **108**. The spring **116** is formed of material sheared from between the spaced wipers **112** and **114**. These wipers are additionally supported by two lower cantilever springs **122** and **124** which bear respectively and independently against the lower ends of the two wipers **112** and **114**.

As before the tail **108** is offset, but in this case it is offset in a direction toward, instead of away from the opposite side of the spring contact. With separate contacts as in FIGS. 2 and 10, the offset is in such direction as to separate the tails, but in FIG. 11 the offset is in a direction toward the common or central tail.

It will be understood that the various methods of anchoring the contacts in the insulation base, illustrated in FIGS. 4, 5, 6, and 7, are applicable to the contacts shown in FIGS. 10 and 11.

The metal used for the contact may be a suitable resilient non-corrosive metal such as phosphor bronze or beryllium copper. This may be plated with cadmium or silver, and for military and other stringent service, the contacts preferably are silver-plated and then gold-plated.

It is believed that the construction and method of use of my improved edge board connector, and particularly the contacts for the same, as well as the advantages thereof, will be apparent from the foregoing detailed description. The wiper surfaces are yieldably supported at both extreme ends, and therefore remain parallel or substantially parallel. A good area of contact is provided, and the contact is dependable because it has two collateral independent wipers, so that at least one or the other makes

good contact. The current flow path from the wipers to the tail is short and direct, with minimum electrical resistance. In many applications the apparatus is subjected to vibration, and in such cases, the use of the spaced independent wipers is particularly important because during vibration one wiper or the other maintains contact.

It will be understood that while I have shown and described the invention in several preferred forms, changes may be made without departing from the scope of the invention, as sought to be defined in the following claims.

I claim:

1. A resilient metal contact for an edge board connector, said contact comprising a ribbon of resilient metal having one end shaped to form a single thickness hook at the upper end of said contact, a spaced pair of elongated parallel wipers depending from said hook, the lower ends of said wipers being free, a tail beneath said wipers, an upper cantilever leaf spring forming an integral continuation of said hook and tail, said upper spring being formed of material sheared from between said spaced wipers, and a lower cantilever leaf spring which is integral with the tail and disposed between the tail and the free lower ends of the wipers.

2. A resilient metal contact for an edge board connector, said contact comprising a ribbon of resilient metal having one end shaped to form a single thickness hook at the upper end of said contact, a spaced pair of elongated parallel wipers depending from said hook, the lower ends of said wipers being free, a tail beneath and generally parallel to but offset from said wipers, an upper cantilever leaf spring forming an integral continuation of said hook and tail, said upper spring being formed of material sheared from between said spaced wipers, and a lower cantilever leaf spring which is integral with the tail and disposed between the tail and the free lower ends of the wipers.

3. A contact as defined in claim 1 in which the tail is reversely folded at its lower end, and in which the lower spring is formed out of the material at the upper end of the reversely folded tail.

4. A contact as defined in claim 2 in which the tail is reversely folded at its lower end, and in which the lower spring is formed out of the material at the upper end of the reversely folded tail.

5. A contact as defined in claim 1 in which there are two spaced parallel lower springs bearing respectively and independently against the lower ends of the two wipers.

6. A contact as defined in claim 2 in which there are two spaced parallel lower springs bearing respectively and independently against the lower ends of the two wipers.

7. A contact as defined in claim 1 in which there are two spaced parallel lower springs bearing respectively and independently against the lower ends of the two wipers, and in which the material between the spaced wipers and between the spaced lower springs forms not only the upper spring, but also a reversely folded locating stop at the upper end of the tail.

8. A contact as defined in claim 2 in which there are two spaced parallel lower springs bearing respectively and independently against the lower ends of the two wipers, and in which the material between the spaced wipers and between the spaced lower springs forms not only the upper spring, but also a reversely folded locating stop at the upper end of the tail.

9. A double contact for an edge board connector, said contact comprising yieldable left and right sides formed respectively at the upper ends of a single reversely folded tail, each side having spaced parallel wipers with upper and lower cantilever springs as defined in claim 1.

10. A double contact for an edge board connector, said contact comprising yieldable left and right sides formed respectively at the upper ends of a single reversely folded

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tail, each side having spaced parallel wipers with upper and lower cantilever springs as defined in claim 2.

11. A double contact for an edge board connector, said contact comprising yieldable left and right sides formed respectively at the upper ends of a single reversely folded tail, each side having spaced parallel wipers with upper and lower cantilever springs as defined in claim 1, and there being two lower springs which are spaced apart and bear respectively and independently against the lower ends of the two wipers.

12. A double contact for an edge board connector, said contact comprising yieldable left and right sides formed respectively at the upper ends of a single reversely folded tail, each side having spaced parallel wipers with upper

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and lower cantilever springs as defined in claim 2, and there being two lower springs which are spaced apart and bear respectively and independently against the lower ends of the two wipers.

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