

[54] **PLURAL CIRCUIT BOARD
CONNECTING ARRANGEMENT AND
TERMINAL THEREFOR**

[72] Inventor: **Kerry M. Krafthefer**, Downers
Grove, Ill.

[73] Assignee: **Molex Products Company**, Downers
Grove, Ill.

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[51] Int. Cl. **H05k 1/02**

[58] Field of Search. 339/17 L, 17 LM, 17 M, 17 LC,
339/176 MP, 252 R, 256 R, 258 R, 258 P,
219-221, 217 R, 176 M, 95 R, 95 D

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Primary Examiner—Marvin A. Champion

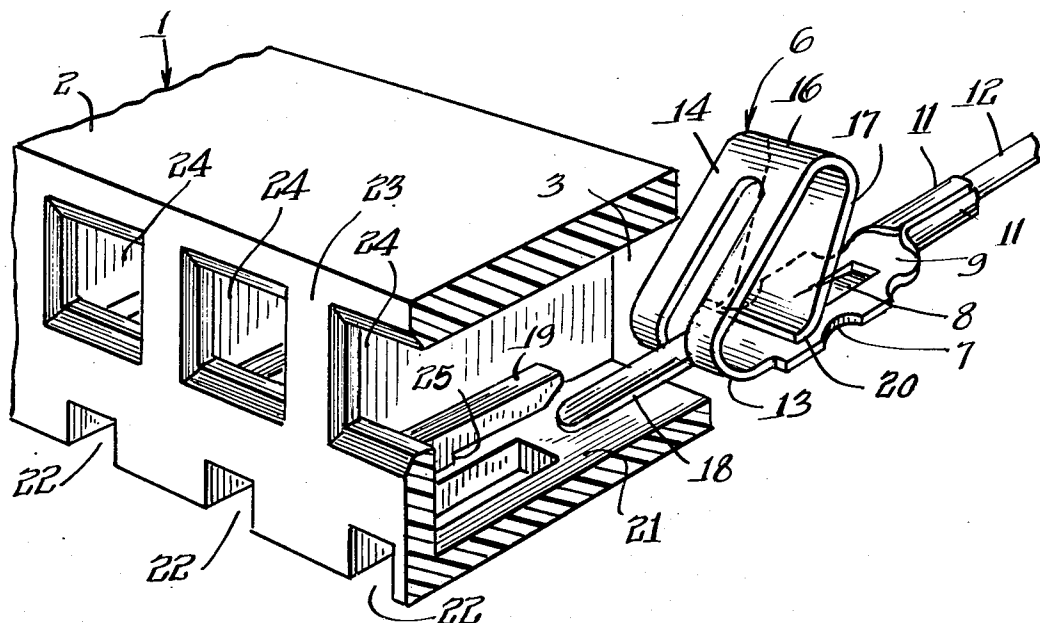
Assistant Examiner—Terrell P. Lewis

Attorney—Olson, Trexler, Wolters & Bushnell

[57] **ABSTRACT**

An electrical connector has a series of terminals each of which has a tongue that projects through the connector for connection to a printed circuit board. Another structure, such as a printed circuit board, switch, wafer, etc., has conductors that project through the first-mentioned circuit board and into said connector for connection with said terminals. The terminals are of the oval-shaped type that impose spring pressure on the conductors.

12 Claims, 9 Drawing Figures



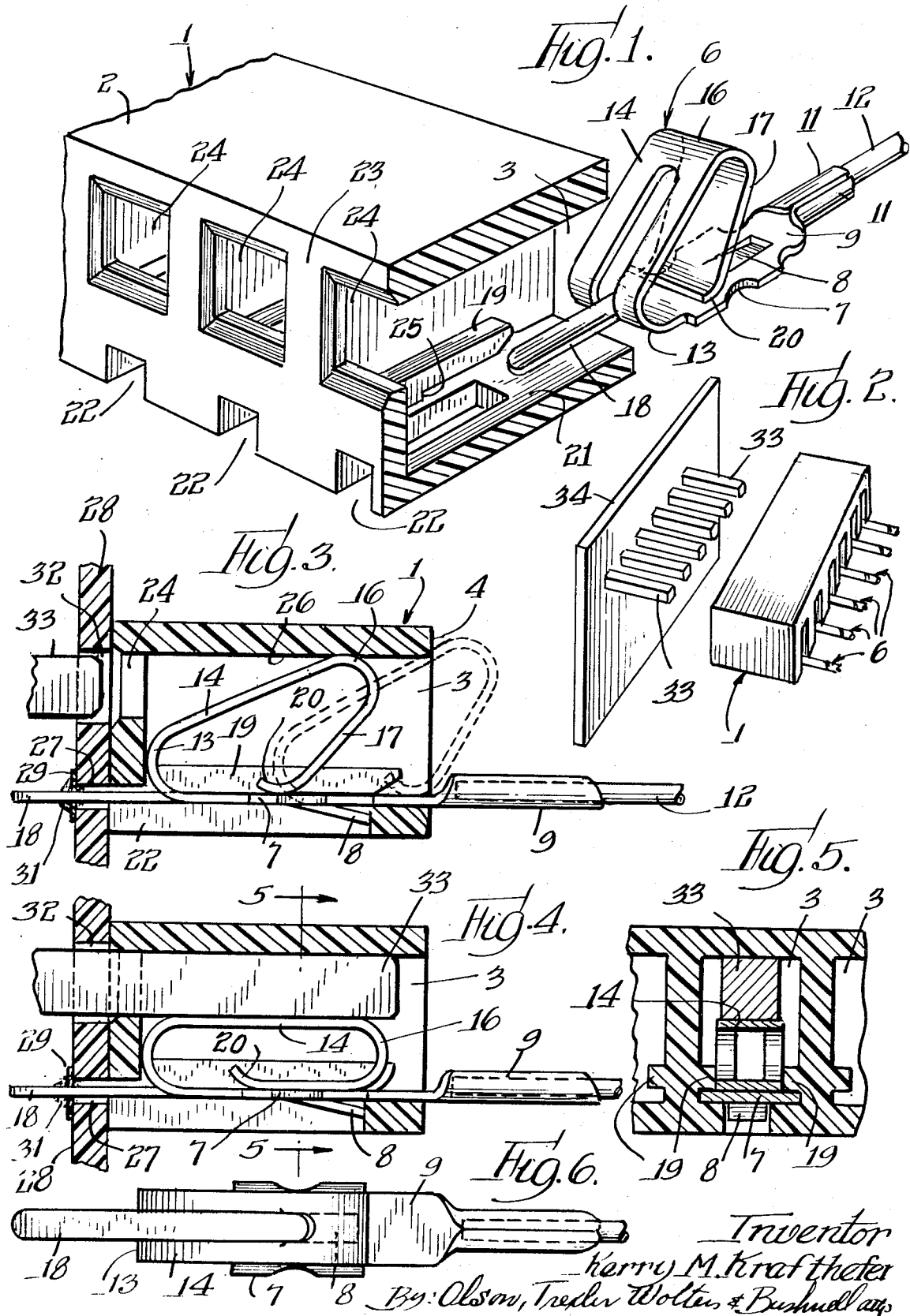


Fig. 7.

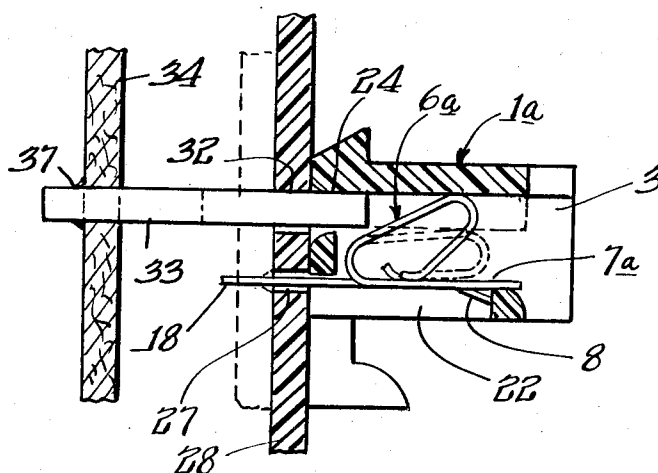


Fig. 8.

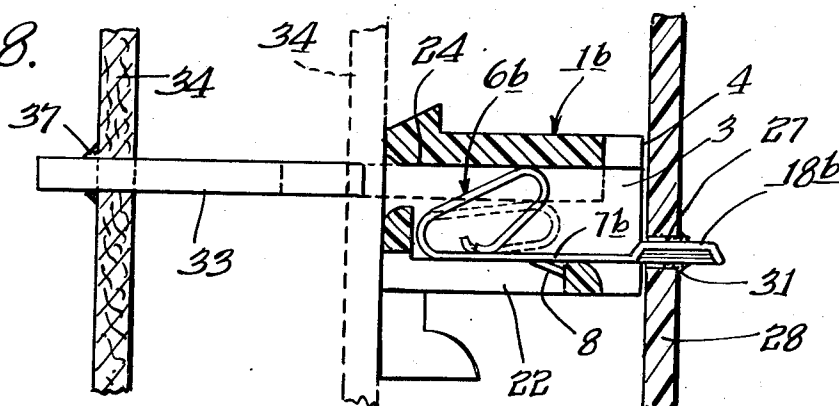
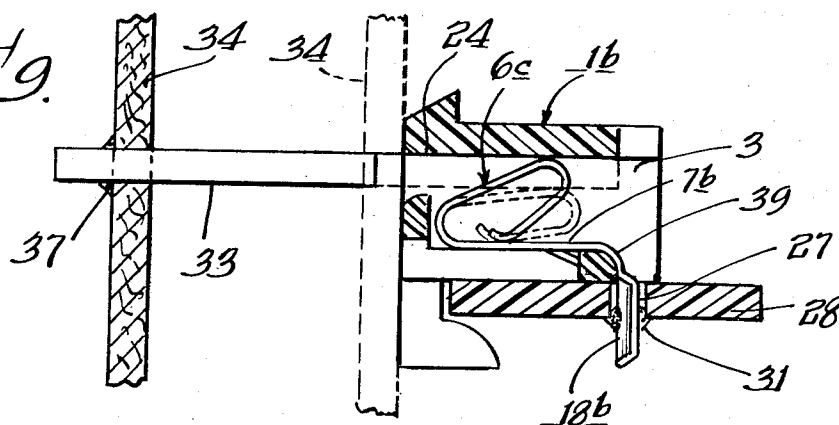


Fig. 9.



Inventor
Kerry M. Krafthefer

By: Olson, Trester, Wollers & Bushnell
attys.

PLURAL CIRCUIT BOARD CONNECTING ARRANGEMENT AND TERMINAL THEREFOR

This invention relates to electrical terminals and to arrangements for electrically and mechanically connecting two circuit-containing members together.

It is known to provide an electrical connector having contact-receiving openings on one face thereof for receiving terminals of the type that are oval-shaped and are resiliently compressible so that when conductors on a printed circuit board with edge connectors are inserted into such openings the spring pressure of the compressed terminals will bear against the edge connectors and form an electrical and mechanical connection. In some arrangements, however, it is desired to provide electrical connections between two printed circuit boards. This can be effected in various ways, for instance by use of an additional connector and additional terminals wired to the first-mentioned terminals and seated in the second connector. Another way printed circuit boards may be connected is by the use of special terminals on the circuit boards and/or special connectors so that circuit boards may be assembled in stacked relationship. Such arrangements, however, tend to be costly.

It is an object of this invention to provide an electrical terminal of the loop-shaped resilient type which is constructed not only for reception into a connector for mechanical and electrical contact with a first-printed circuit board, but also has structure for electrical connection to a second circuit board, or other circuit-containing structure whereby the two circuit-containing structures are electrically and mechanically connected, utilizing only a single connector and a single series of terminals.

It is a further object of this invention to provide a terminal of the type stated having a tongue that projects through the connector for connection with a circuit board.

It is also an object of this invention to provide an arrangement of the type stated wherein the first of the two circuit boards has conductors that project through the second of the circuit boards, the conductors on the first board extending into the connector for engagement with terminals therein and being held in the connectors by the spring pressure of the terminals.

In printed circuit boards having edge connectors that engage looped or double cantilever terminals in a connector, there is frequently the need to plate the contacts in order to reduce oxide formations which may prevent proper electrical contact with terminals. In addition high contact pressures are often required in order to cut through such oxide film as may build up on the circuit board contacts. In some instances the contact pressure may result in stripping the edge connectors.

Accordingly, it is a further object of this invention to provide an arrangement in which a circuit-containing structure such as a circuit board, switch, etc., has a plurality of individual conductor pins that plug into respective recesses in a connector for connection with a loop terminal. The pins are strong enough to take the contact pressures required to strip through any oxide film thereon.

The attainment of the above and further objects of this invention will be apparent from the following detailed description when taken in conjunction with the accompanying drawings forming a part thereof.

In the drawings:

FIG. 1 is a fragmentary perspective view, partially in section, illustrating a terminal and connector constructed in accordance with and embodying the present invention;

FIG. 2 is a perspective view showing a connector and one of the printed circuit boards that forms part of the present invention;

FIG. 3 is a fragmentary transverse sectional view showing the terminal assembled with the connector and with a second of the two circuit boards, and further showing the first of the two circuit boards in position preparatory to assembly with the connector;

FIG. 4 is a sectional view similar to FIG. 3 but showing the first circuit board assembled with the connector;

FIG. 5 is a fragmentary sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is a top plan view of the terminal of the present invention;

FIG. 7 is a sectional view showing a modified form of the invention;

FIG. 8 is a sectional view showing a further modified form of the invention; and

FIG. 9 is a sectional view showing still another form of the invention.

Like reference numerals indicate like parts throughout the drawings.

Referring now in more detail to the drawings, 1 designates a connector of dielectric material, such as molded nylon or other suitable plastic, and having an elongated one piece body 2. The connector has a series of spaced apart parallel recesses 3 which open up to the front face 4 of the body 2 for receiving a series of electrical terminals 6, one of which is herein shown in detail.

The terminal 6 is fabricated of a single piece of sheet brass which is formed to the shape shown and spring tempered to provide a resilient body. The terminal 6 has a base 7 with a lance 8 struck outwardly therefrom, the base including a tailpiece 9 with crimping arms 11, 11 for crimping a wire 12. Also, the terminal 6 includes at its forward end an arcuate first juncture portion 13 which curves upwardly and rearwardly. The juncture portion 13 merges with a first or contact-making leg 14 which lies at an acute angle to the base 7, and the leg 14 merges with a reversely curved second juncture portion 16. The juncture portion 16 merges with a second leg 17 that terminates in a lip 20 slidable on the base 7. Thus, the legs 14, 17 and the parts 13, 16, 20 and a portion of the base 7 cooperate to form a loop which is generally oval-shaped and which is capable of a modicum of flattening.

Extending forwardly from the base 7 and substantially co-planar therewith is a tongue 18 which is struck-out from the juncture portion 13 and the leg 14. The tongue 18 is preferably struck from the center section of the portion 13 and leg 14 and extends a substantial distance forwardly of the portion 13, for purposes presently more fully appearing.

In each recess 3 the connector 1 is formed with laterally projecting ribs 19, 19 which cooperate with the bottom wall 21 of the recess 3 to provide spaces that receive the lateral edge portions of the terminal base 7 and serve to locate the terminal 6 in a predetermined position within the recess 3. Each rib 19 also has a stop

shoulder 25 that serves to limit the insertion of the terminal 6 into the recess 3. The connector 1 is also formed with a downwardly opening slot 22 for receiving the lance 8, and by which accidental retraction of the terminal 6 of the recess 3 is prevented. Finally, the rear side 23 of the terminal 1 has an opening 24 into each recess 3, the openings 24 being located substantially at the upper portion of the rear side 23.

The normal height of the terminal 6 is greater than the height of the recess 3. Thus, when the terminal 6 is inserted into the recess 3, the juncture portion 16 or the upper part of the leg 17 will engage the top wall 26 of the recess 3, as shown in broken lines in FIG. 3. As the terminal 6 is pushed all the way into the recess 3, the terminal will flatten somewhat, as shown in full lines in FIG. 3, and the tongue 18 will project outwardly of the rear side 23 of the connector 1 through the opening 22.

The tongue 18 also projects through an opening 27 in a printed circuit board 28 having circuit wiring 29 thereon. The tongue 18 is secured as by solder 31 to the circuit wiring 29 so that the circuit board 28 is fixed with respect to the connector 1. The soldering of the tongue 18 to the circuit board 28 may be carried out for each terminal in each recess 3. The circuit board 28 also has holes 32 for receiving solid wire conductors 33 on another structure which may be a printed circuit board 34, switch, wafer, or other circuit-containing member. These conductors 33 and the holes 32 and 24 are of similar cross-section, being square in the embodiment of the invention herein illustrated. A soldered connection 37 (see FIGS. 7-9) secures the conductors 33 to the structure 34.

When the circuit board 34 is plugged into the connector 1 by inserting the conductors 33 through the holes 32 in the printed circuit board 28 and into the corresponding holes 24 on the connector 1, the conductors 33 flatten out the respective terminals 6 to some extent, as shown in FIG. 4. Each conductor 33 is confined between a terminal 6 and the wall 26 by reason of the spring pressure exerted by the terminal 6, thereby forming a mechanical and electrical connection between the individual conductors 33 and the respective terminals 6. At the same time the circuitry of the circuit board 34 is connected to the circuitry of the circuit board 28 through the tongues 18 of each terminal 6.

While there is herein shown a series of spaced apart openings 24 and a series of companion-shaped conductors 33, the openings may, at least in principle, be in the form of a single elongated opening that receives a circuit board with edge connectors which engage the respective terminals 6, despite whatever drawbacks may be attendant to edge connectors.

In FIG. 7 the connector 1a is substantially similar to the connector 1 and receives a terminal 6a in the recess 3. The terminal 6a is like the terminal 6 except that the base 7a does not include crimping arms.

In FIG. 8 the connector 1b receives a terminal 6b in the recess 3. In this form of the invention, however, the base 7b extends toward the front face 4 of the connector 1b to provide the tongue 18b which is offset as shown and projects through the circuit board 28, being soldered thereto at 31. Thus, the two circuit boards 28, 34 may be connected together and yet be on opposite sides of the connector 1b.

In FIG. 9, the terminal 6c is designed to attach the circuit board at the lower side of the connector 1b so that the two circuit boards 28, 34 are at right angles to each other. For this purpose the base 7b is turned through a right angle bend 39 so that the tongue 18b projects downwardly and through the hole 27 for attachment to the circuit board 28.

In each of FIGS. 7-9, the structure 34 and terminal are shown in full lines preparatory to insertion of the spaced conductors 33 into their respective openings 24. The illustration in broken lines shows the parts assembled.

While a preferred embodiment of the invention has been herein shown and described, it will be understood that various changes are contemplated, and all that which falls within the purview of the following claims is to be considered as part of the present invention.

The invention is claimed as follows:

1. In combination with an electrical connector having a recess, an electrical terminal in said recess, means on said terminal and connector for maintaining the two in assembled relationship, said terminal having a loop-shaped portion with a tongue extending from said loop, said tongue being struck from said loop, said tongue also projecting outwardly of said recess, and a circuit-containing member electrically and mechanically joined to the outwardly projected part of said tongue.

2. A combination according to claim 1 in which said terminal comprises a resilient body having a base, a first juncture portion extending from said base, a first leg joined to said juncture portion remote from said base and lying at an acute angle to said base, a second juncture portion joined to said first leg remote from said first juncture portion, a second leg joined to said second juncture portion remote from said first leg and projecting from the second juncture portion toward said base, the base, the legs and the juncture portions forming a generally loop-shape capable of a modicum of flattening.

3. A combination according to claim 1 in which the tongue forms a continuous extension of the base.

4. A combination according to claim 1 in which said tongue projects outwardly of said recess through one opening in the connector, and said connector has another opening into said recess for receiving an electrical conductor to be engaged by said terminal.

5. In combination with a one piece electrical connector having a recess, an electrical terminal in said recess, said recess having opposed peripheral walls, cooperating means on the connector and terminal for retaining said terminal in said recess and the adjacent peripheral wall having an open slot therethrough permitting access to the cooperating means retaining the terminal in the recess, said terminal having a loop-shaped portion with a transverse dimension that is less than the distance between said opposed walls so that the terminal is partially flattened by said walls upon insertion into said recess, a tongue on said terminal and projecting outwardly of said recess with the end thereof disposed exteriorly of said recess at one end thereof, a circuit-containing member that receives the exterior end of said tongue exteriorly of said connector, means for joining said tongue to said member and including means for electrically connecting the tongue to circuitry on said member, and a second circuit-containing member having a conductor projecting into said recess

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from the opposite end thereof for engagement with and further flattening of said loop-shaped portion of said terminal and with the terminal applying pressure to said conductor to confine said conductor between said loop-shaped portion and one of said opposed walls and in only frictional pressure engagement with each, whereby said conductor is retractable from said connector independently thereof by overcoming the frictional pressure engagement between the connector wall and the loop-shaped portion of the terminal.

6. A combination according to claim 5 in which the two circuit-containing members are panels containing printed circuits.

7. A combination according to claim 6 in which said panels are adjacent to each other and are on the same side of the connector.

8. A combination according to claim 6 in which said panels are on opposite sides of the connector.

9. A combination according to claim 6 in which the panels are substantially perpendicular to each other.

10. A combination according to claim 5 in which said

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means for joining said tongue to the first-mentioned member comprises a soldered connection between the two.

11. A combination according to claim 5 in which said tongue extends from said base and is turned substantially at a right angle thereto.

12. An electrical terminal comprising a resilient body having a base, a first juncture portion extending from said base, a first leg joined to said juncture portion remote from said base and lying at an acute angle to said base, a second juncture portion joined to said first leg remote from said first juncture portion, a second leg joined to said second juncture portion remote from said first leg and projecting from said second juncture portion toward said base, the base, the legs and the juncture portions forming a generally loop-shape capable of a modicum of flattening, a tongue extending from said base and being struck out of at least said first juncture portion.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,697,926 Dated October 10, 1972

Inventor(s) Kerry M. Krafthefer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

claim 5, column 4, line 56, change "less" to -- greater -- .

Signed and Sealed this

Sixth Day of July 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks