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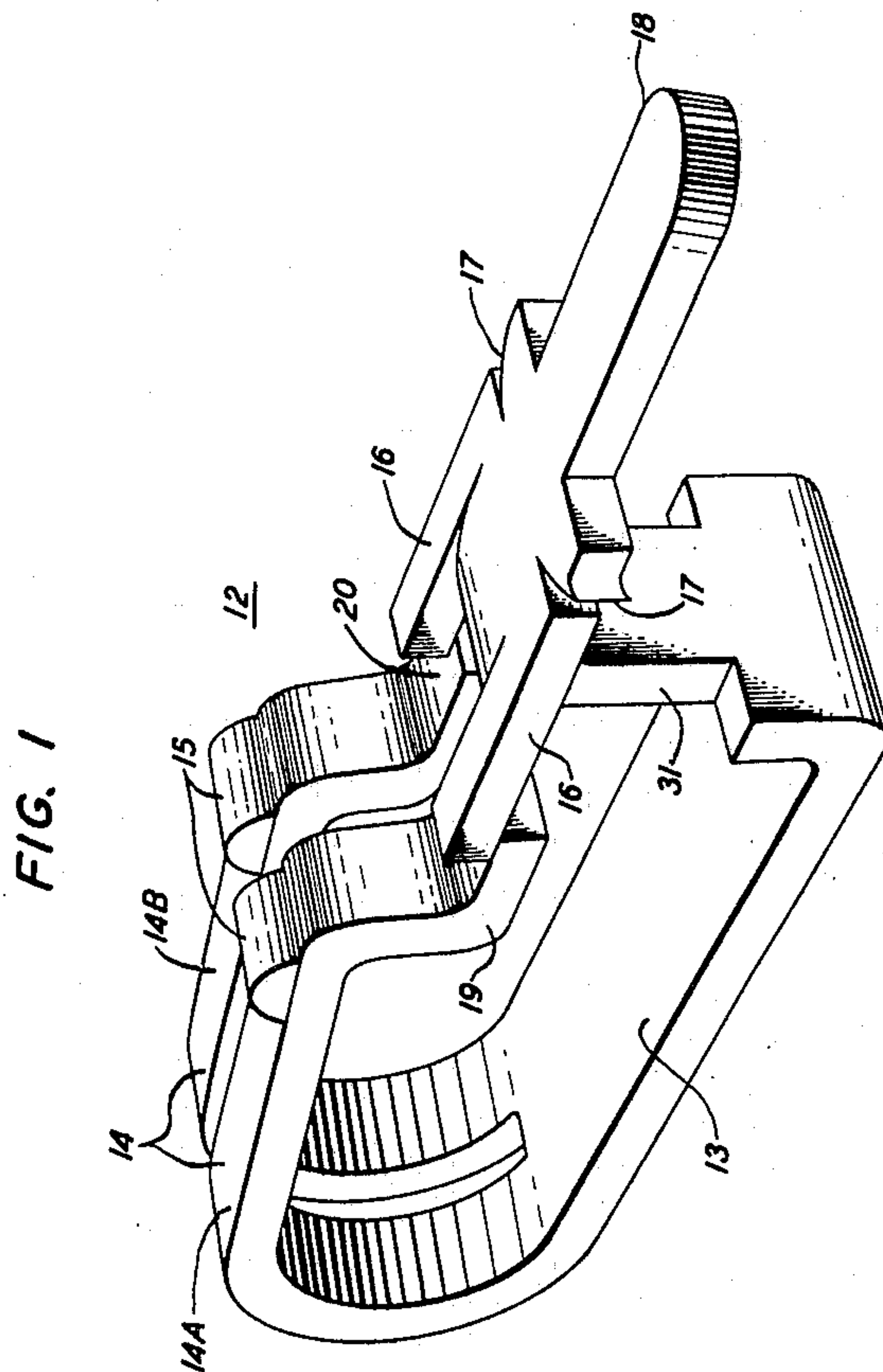
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3,234,499

PRINTED CIRCUIT BOARD CONNECTOR

Original Filed July 31, 1962

2 Sheets-Sheet 1



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FIG. 2

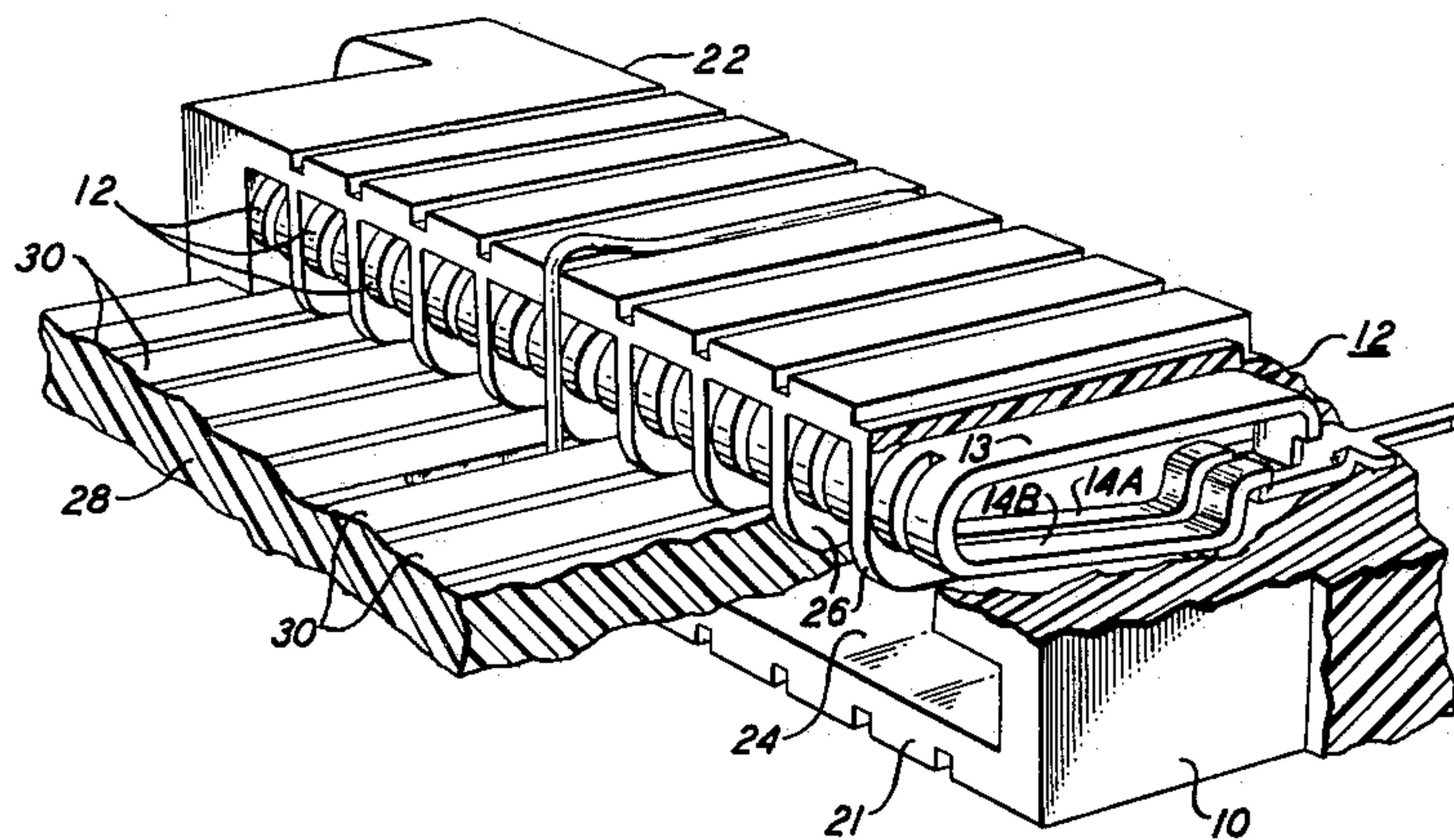


FIG. 3

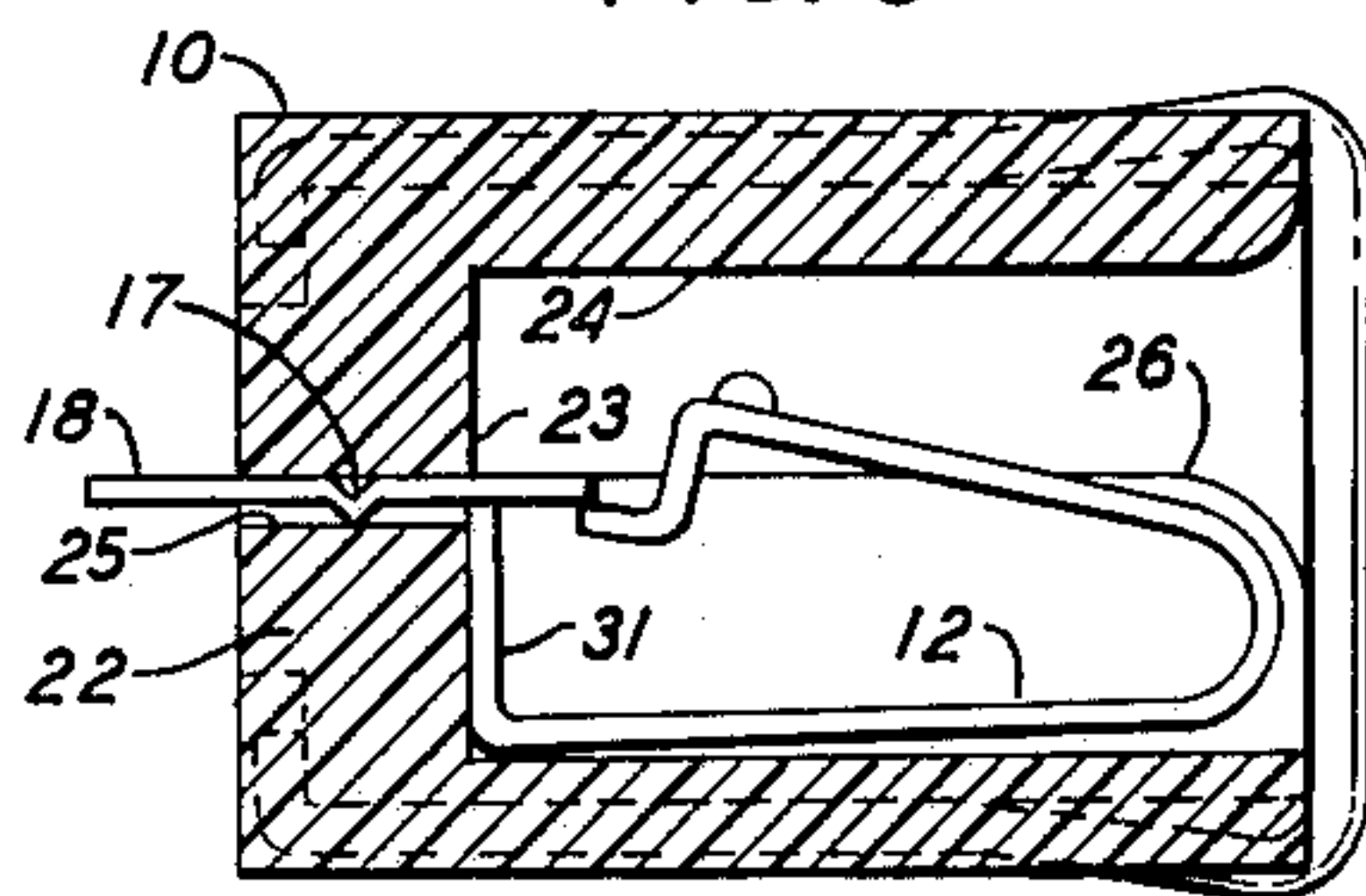
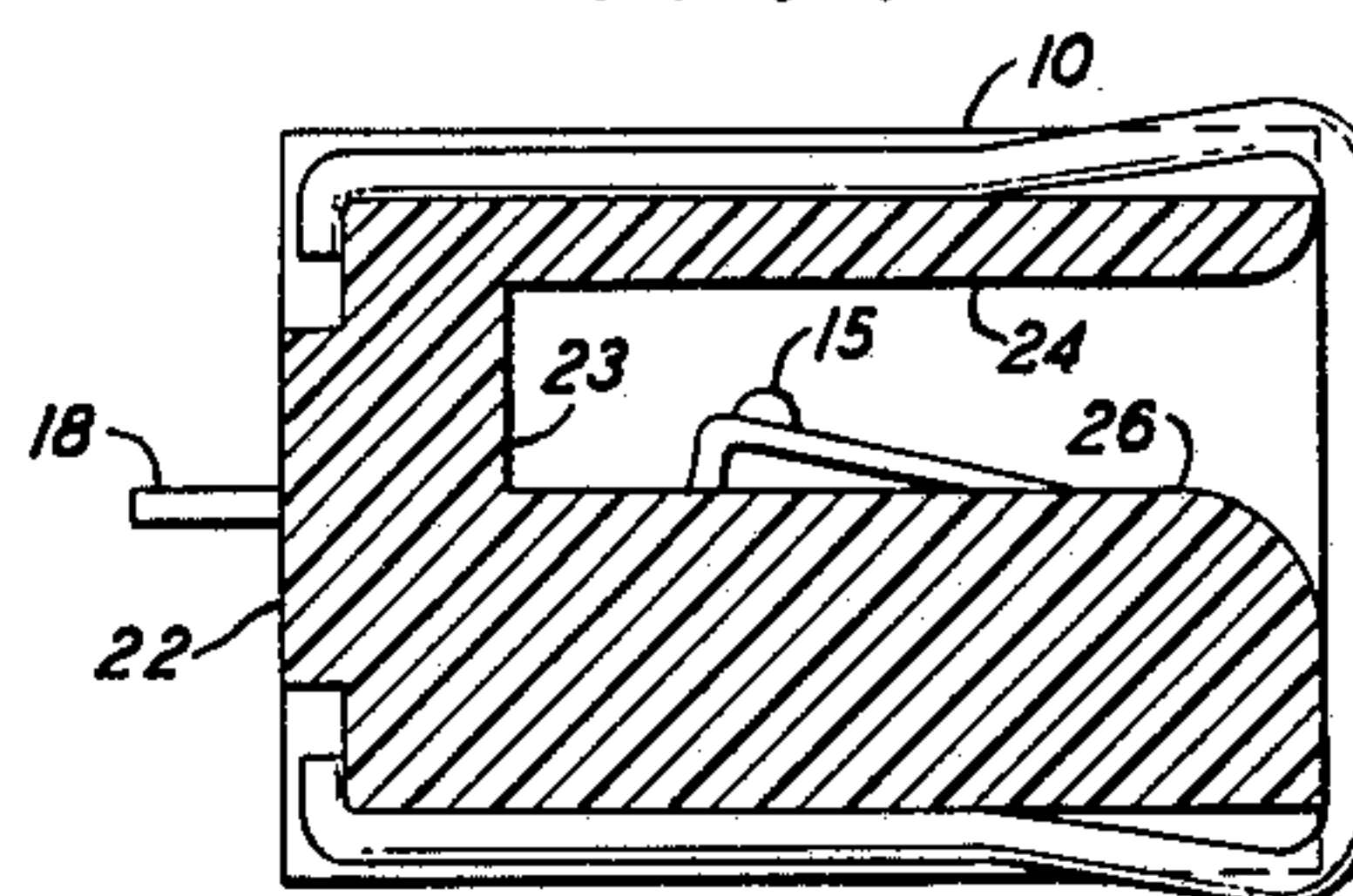


FIG. 4



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PRINTED CIRCUIT BOARD CONNECTOR

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Continuation of application Ser. No. 213,642, July 31, 1962, now Patent No. 3,172,719, dated Mar. 9, 1965. This application Aug. 5, 1964, Ser. No. 387,598

6 Claims. (Cl. 339-176)

This invention is a continuation of our application Serial No. 213,642, filed on July 31, 1962, that issued as U.S. Patent 3,172,719 on March 9, 1965 and relates to electrical devices for making connections with printed circuit boards, and more specifically to electrical devices having terminals that are pre-tensioned in and of themselves.

When making electrical connections between terminals in a connector and their mating structure, sufficient contact force must be supplied to the terminal to insure electrical continuity. Since the majority of connectors employ terminals with a spring contact, the contact force is proportional to the deflection of the spring contact. Sufficient contact force necessitates either a large deflection of the spring contact or pre-tensioning of the spring contact, the latter being most desirable but old in the art.

Most connectors comprise an insulating block, having electrical terminals contained within the block in an appropriate geometric pattern. The terminals include a contact member, the latter most generally being pre-tensioned against a rib or other suitable restraining means that is part of the connector block. The pre-tensioning is obtained when the terminal is inserted in the connector block. The contact member is biased by the rib or restraining means of the connector block in such manner as to pre-tension the contact member in a desired direction. The terminal in its free position, that is, when it is not inserted in the connector block, is not pre-tensioned because of the lack of the interaction between the terminal contact member and the rib or restraining means of the connector block. Back up springs, cams and the like are other devices incorporated in other electrical connectors to obtain adequate pre-tensioning of the terminal contact member.

The pre-tensioning obtained in the above-mentioned devices is derived by the interaction of the contact member of the terminal working in conjunction with structures other than that of the terminal. Since the amount of pre-tensioning of the terminal contact member is critical in some applications, it is desirable to be able to measure the amount of pre-tensioning of the terminals.

Because the above-described terminals derive this pre-tensioning from the interaction of the terminal contact member with an appropriate structure of a connector block, the amount of pre-tensioning can not be measured without inserting the terminals in a connector block, special measuring jig or fixture. If an adjustment as to the amount of pre-tensioning is necessary, the terminal must be extracted from the connector block, jig or fixture, adjusted, and then reinserted back into the block, jig or fixture for further measurement and verification. In some instances, the insulating block may vary in critical dimensions and terminals which have been measured and adjusted for the proper amount of pre-tensioning in a special jig or fixture may change in the amount of pre-tensioning when placed in an insulating block. Also, terminals dependent on pre-tensioning derived from the interaction of the terminal contact member with structure other than its own, are subject to variances in critical dimensions of the structure with which it interacts and the amount of pre-tensioning of a multiplicity of terminals may vary with every terminal in the insulating block.

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An object of the invention is to provide a printed circuit board connector wherein the pre-tensioning of the terminal contact members can be measured and adjusted before the terminals are inserted in the connector block.

A feature of the invention resides in an electrical connector wherein the terminals of the connector are pre-tensioned in and of themselves.

A preferred embodiment of the invention comprises an insulating block having a plurality of self pre-tensioned terminals. The terminals are formed out of resilient sheets of electrically conducting material which are bent back upon themselves near a center portion to form two arms. The second arm is bifurcated from adjacent the first arm to the end of the second arm, thereby forming two contact members. Bifurcation of the second arm is deemed essential to insure electrical contact between the board and the connector. If dirt or some other foreign insulating material should by chance prevent electrical continuity between one contact member and the electrical circuit on the printed circuit board, the other contact member provides an alternate electrical path, thereby insuring electrical contact between the printed circuit board and the connector terminal. To further insure electrical contact, each contact member includes a precious metal contact portion.

On the end of the first arm of the terminal are located two lugs and an embossed portion. The embossed portion cooperates with the insulation block to properly hold the terminals within the block in predetermined positions. Those familiar with the connector art will recognize that the function of the embossed portion is to secure the terminal in the connector block. Other equivalent deforming means such as tabbing and punching are within the scope of this disclosure. The two lugs are formed to cooperate with the ends of the two contact members. The lugs restrict the motion of the two members in a direction away from the first arm, thereby creating a pre-tensioning of the contact members.

The insulation block of the connector has an elongated rectangular cavity in its front surface to receive a printed circuit board. The terminals are located along the elongated side walls of the block, each having an extended element that protrudes through the rear surface of the block to communicate with an electrical conductor. Each terminal is separated from the next terminal by a rib or protrusion from the side wall.

The invention will be more clearly understood from the following detailed description, when read in conjunction with the drawing, in which:

FIG. 1 is an isometric view of the terminal;

FIG. 2 is a sectioned isometric view of a connector showing the terminals and printed circuit board;

FIG. 3 is a section view of FIG. 2 taken through an electrical terminal; and

FIG. 4 is a section view of FIG. 2 taken through a terminal separating rib.

According to the invention, as depicted by the various figures, the connector comprises an insulating block 10, and a multiplicity of electrical terminals 12.

As shown in FIG. 1, the electrical terminals 12 are formed from a flat sheet of resilient electrically conducting material bent back upon itself to form two arms 13 and 14. The second arm 14 is bifurcated from near the arm 13 to the end of arm 14, thereby defining two contact members 14A and 14B. The contact members 14A and 14B further include precious metal contact portions 15.

The end of the arm 13 is bent at an angle of 90 degrees to itself toward contact members 14A and 14B. Near the end of the arm 13 are two lugs 16, an embossed portion 17, and an extended element 18. The free ends 19 and 20 of the members 14A and 14B are also bent

back toward arm 13 so that the lugs 16 operatively contact the free ends 19 and 20, restricting their movement in a direction away from arm 13. The restricting of the ends 19 and 20 by the lugs 16 pre-tensions the contact members 14A and 14B. The terminal is therefore pre-tensioned against itself and the amount of pre-tensioning can be measured and adjusted while the terminal 12 is outside of the connector block 10.

The pre-tensioning is determined during the manufacturing process by fixing the relative positions of the lugs 16 with respect to the ends 19 and 20 of the contact members 14A and 14B. If properly made, a terminal 12 will not require an adjustment of the pre-tensioning but it is obvious that if such adjustment is required, bending of the lugs 16 either up or down will increase or decrease the amount of pre-tensioning as desired. This process of adjustment can be carried out before the terminal 12 is inserted into a connector block 10. Subsequent insertion of the terminal 12 into the insulating block 10 does not affect the amount of pre-tensioning because the pre-tensioning is in no way a function of the dimensions of the connector block 10 nor any other structure other than its own.

The connector block 10 includes a front surface 21 and a rear surface 22. In the front surface 21 is located an elongated rectangular opening leading into an interior cavity 24. The interior cavity 24 has a floor surface 23 with rectangular holes 25 that communicate through the floor surface 23 to the rear surface 22. Along at least one side wall is located a plurality of terminals 12 separated on the inside of the side wall by a series of ribs or projections 26.

The assembly of the connector can best be discussed with reference to FIGS. 3 and 4. The terminals 12, after having been adjusted for the proper amount of pre-tensioning, are inserted into the connector block 10. The terminals 12 fit between the separating projections 26 so that each terminal 12 is separated by a rib 26 from its neighbor. The extended element 18 of the terminals 12 protrude through the rectangular holes 25 in the floor surface 23 to communicate with incoming electrical conductors by the various known means of soldering, wrapping, crimping and the other like means. The length and configuration of the extended element 18 are determined by the method chosen for making the connection to the incoming conductors. The embossed portions 17 of the terminals 12 interfere with the sides of the holes 25 to secure the terminals 12 in the block 10 and to locate them in a predetermined position against appropriate reference surfaces. It is to be noted in FIGS. 3 and 4 that the precious metal contact portions 15 with their respective contact members, extend beyond the separating projections 26 to effect electrical connection with an inserted printed circuit board 28.

The operation of the connector can best be illustrated with reference to FIG. 2. The printed circuit board 28 has a plurality of printed circuit leads 30. The dimensions of the terminals 12 and the printed circuit leads 30 are such that both contact members 14A and 14B of a terminal 12 come in contact with a single printed circuit lead 30.

FIG. 2 shows a printed circuit board 28 inserted in a connector. It is evident that if dirt or some other foreign insulating substance was accidentally introduced between contact member 14A and its associated printed circuit lead 30, that contact member 14B of the same terminal 12 would provide an alternate electrical path to the same printed circuit lead 30. High reliability is thereby obtained by the dual contact member structure.

As mentioned previously, the pre-tensioning of the terminal 12 is accomplished during manufacturing, and adjustment, if necessary, is done before the terminal 12 is inserted in the block 10. Insertion of the terminal 12 must be executed without altering or destroying the pre-tensioning of the contact members 14A and 14B.

It is obvious that the invention is not limited to the specific structure illustrated and that it may be employed by those skilled in the art in ways too numerous to mention. Such use is within the scope of the appended claims.

What is claimed is:

1. An electrical connector for receiving a printed circuit board having a plurality of spaced circuit paths extending to one edge of said board, comprising the combination of an insulating block and a plurality of pre-tensioned terminals; said block having an elongated slot extending into a front face of said block for receiving said board, said block including a plurality of ribs extending into said slot to form compartments in alignment with said paths, said block having openings extending from said compartments through a rear face of said block, said compartments each including at least one of said terminals, each of the latter comprising a strip of resilient metal bent back upon itself in a portion to form a U-shape having two arms, said arms being spaced apart for their entire length, said arms having free ends distant from said portion, said first arm having retaining means and pre-tensioning means located adjacent its free end and adapted to butt up against the interior side walls of said slot between said ribs, said retaining means adapted to interfit with said openings and retain said terminal in said block, and said pre-tensioning means operatively cooperating with the free end of said second arm to restrain and bias said second arm in a direction toward said first arm thereby pre-tensioning said second arm, said second arm including electrical contact portions.

2. A connector for a printed circuit board comprising the combination of an insulating block and a plurality of self pre-tensioned terminals, said block having front and rear surfaces joined by side walls and an elongated cavity in said front surface to receive said board, said block having ribs projecting from the interior of said cavity side walls that run in a direction perpendicular to said front and rear surfaces and divide said side walls into compartments, each of said compartments including a mounting opening in said rear surface, each of said compartments further including at least one terminal, the latter comprising a flat sheet of resilient electrically conducting metal bent back upon itself in a portion to form a U-shape having two arms, said arms being spaced apart for their entire length, said arms having free ends distant from said portion, said first arm having retaining means and pre-tensioning means located adjacent its free end and adapted to butt up against said interior side walls between said ribs, said retaining means adapted to interfit with said mounting opening and retain said terminal in said block, said pre-tensioning means operatively cooperating with the free end of said second arm to restrain and bias said second arm in a direction toward said first arm thereby pre-tensioning said second arm, said second arm including electrical contact portions.

3. A connector comprising a plurality of self pre-tensioned terminals in combination with an insulating block, said terminals comprising a flat sheet of resilient electrically conducting material bent back upon itself in a portion to form a U-shape having two arms, said arms being spaced apart for their entire length, each of the latter having a free end distant from said portion, the free end of said first arm being bent at a 90 degree angle to itself toward said second arm, said last mentioned end including retaining means and restraining lugs, said retaining means being adapted to retain said terminals in said block, said second arm being bifurcated from adjacent said first arm to the end of said second arm to form two contact elements, said lugs restraining motion of said elements in a direction away from said first arm but permitting motion of said elements toward said first arm, thereby pre-tensioning said elements, said insulating block having front and rear surfaces joined by side walls and an elongated rectangular cavity in said

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front surface to receive a printed circuit board, said insulating block further having projections from the interior side walls of said cavity, said projections running in a direction perpendicular to said front and rear surfaces dividing said side walls into terminal receiving openings, each of said openings including at least one of said terminals.

4. An electrical terminal comprising a flat sheet of resilient electrically conducting material bent back upon itself in a portion to form a U-shape having two arms, said arms being spaced apart for their entire length, the latter having free ends distant from said portion, the first arm having retaining means and pre-tensioning means located adjacent its free end, said retaining means being adapted to retain said terminal in an insulating block, said pre-tensioning means operatively cooperating with the free end of the second arm to restrain and bias said second arm in a direction toward said first arm, thereby pre-tensioning said second arm, said second arm including electrical contact portions.

5. An electrical terminal according to claim 4 wherein said pre-tensioning means comprises two lugs and said second arm is bifurcated from adjacent said first arm to the end of said second arm defining two contacts, said lugs operatively cooperating with the ends of said contacts to restrain and bias said ends in a direction toward said first arm.

6. An electrical terminal comprising a flat sheet of resilient electrically conducting material bent back upon itself in a portion to form a U-shape having two spaced apart arms, each of the latter having a free end distant from said portion, the free end of said first arm being bent at a 90 degree angle to itself toward said second arm, said last mentioned end including retaining means and

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restraining lugs, said retaining means being adapted to retain said terminal in an insulating block, said second arm being bifurcated from adjacent said first arm to the end of said second arm to form two contact elements, said lugs restraining motion of said elements in a direction away from said first arm but permitting motion of said elements toward said first arm thereby pre-tensioning said elements, each of the latter including precious metal contacts.

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