Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention.)
Description

TECHNICAL FIELD

[0001] The present invention relates to an electric connection structure between an integrated circuit (IC) device and a printed circuit board, and in particular, to a structure of a test socket for testing an integrated circuit.

BACKGROUND ART

[0002] An integrated circuit fabricated through complicated processes is subject to various electric tests for a characteristics measurement or quality inspection. In this respect, a socket is frequently used in order to electrically connect a test circuit of a printed circuit board installed at a test equipment to an external terminal (outer lead) of the IC device. That is, for testing the IC device, the socket serves as an interface for electrically connecting the printed circuit board of the test equipment and an IC device.

[0003] A conventional test socket structure will now be described with reference to accompanying drawings.

[0004] Generally, as shown in Figure 1, a test socket of an IC device includes a socket housing 10 and a plurality of contact fingers (contact terminals) 11. The contact finger is formed curved in a semicircle shape so as to have a spring elastic force by a downward pressing pressure. Reference numeral 12 denotes a fixing pin for fixing the IC device so that the electrical connection between the contact finger and the outer lead of the semiconductor device is not unstable while the IC device is being tested.

[0005] Figure 2 shows a device under test (DUT) 14 as mounted on the socket. The device under test 14 is mounted on the socket in a manner that an outer lead 15 of the device under test 14 is contacted by an upper terminal 11a of the contact finger 11. For performing the test, the lower terminal 11b of the contact finger 11 is mounted to be necessarily contacted on a printed circuit (not shown) of the printed circuit board of the test equipment.

[0006] Thereafter, the device under test 14 is pressed down by a pressing unit (not shown), so that the outer lead of the device under test and the upper terminal 11a of the contact pin of the socket are electrically connected by the press-down contact, and the lower terminal 11b of the contact pin and a circuit pattern (not shown) formed on the surface of the board of the test equipment are also electrically connected by the press-down contact.

[0007] The device pressing unit (not shown) renders effective, each contact pins should be replaced one by one, in case that plural contact pins are damaged. Any defective contact pin can be replaced by a normal one whenever it occurs.

[0008] With those problem occurring, eventually, a contact finger having a weakened spring elastic force among the plural contact fingers would cause a contact inferiority or a contact instability over such connection between the device under test and the external terminal, even though the device under test is pressed down by the pressing pressure.

[0009] Such a contact finger having the weakened spring elastic force must be replaced by a new normal one. In this respect, in case of a socket having the contact finger and the socket housing as an incorporated one, even if there occurs a contact deterioration or contact instability for a single contact finger, the high-priced socket itself needs to be replaced by a new one, which inevitably incurs a heavy expense for testing with a prodigal waste.

[0010] In order to resolve such a problem, the U.S. Patent No. 5,634,801 discloses a test socket having a structure that a defective contact pin is individually replaced, as illustrated in Figures 3A and 3B, details of which will now be described.

[0011] The socket shown in Figure 3A includes a housing 30, a plurality of contact pin receiving slots 31 each arranged in parallel at predetermined intervals within the housing 30, an upper and a lower cavities 32a and 32b each formed at an upper surface and a lower surface of the housing. The upper cavity 32a formed at the upper surface of the housing 30 and the lower cavity 32b formed at the lower surface of the housing 30 are positioned at marginal portions in mutually opposite side of the slot.

[0012] Elastomer 33a and 33b are respectively installed within the upper and lower cavities 32a and 32b. Inside each of the contact pin receiving slot 31, S-shaped contact pins 34 are respectively inserted, of which an upper end portion and a lower end portion are respectively rested on the elastomers.

[0013] Reference numeral 35 denotes a printed circuit board of the test equipment, and reference numeral 36 denotes a circuit pattern formed on the printed circuit board, which is connected to the lower surface of the contact pin 34.

[0014] Figure 3B is a longitudinal-sectional view taken along line IV-IV of Figure 3A.

[0015] As described above, the conventional socket has an advantage in that since each contact pin 34 is individually installed in each contact pin receiving slot 31, any defective contact pin can be replaced by a normal one whenever it occurs.

[0016] Nevertheless, it also has disadvantages in the following aspects.

[0017] First, in case that plural contact pins 34 are defective, each contact pin should be replaced one by one,
causing inconvenience and taking much time for replacing the contact pins.

[0018] Second, in order to perform testing, when the IC device (not shown) is pressed downwardly ("a" direction) as is mounted on the upper portion of the contact pin, the lower surface portion 34a of the contact pin 34 moves in the horizontal direction to the circuit pattern, that is, in a 'b' direction toward inside the socket, while being contacted with the circuit pattern 36 of the printed circuit board.

[0019] In addition, after finishing the testing, when the semiconductor device is raised upward ("c" direction), the lower surface portion 34a of the contact pin 34 moves in the horizontal direction, that is, 'd' direction opposite to the 'b' direction.

[0020] Accordingly, the testing of the semiconductor device is repeatedly done, the lower surface portion 34a of the contact pin 34 moves in the 'b' and 'd' directions. Consequently, repeated movement of the lower surface portion 34a causes an abrasion on the part of the circuit pattern 36 where the contact pin is continuously contacted thereto, creating a problem of deterioration on the printed circuit board of the high-priced test equipment.

[0021] Fabricating method of the contact pin or the contact finger of the conventional test socket is as follows.

[0022] As shown in Figure 4A, a metal plate 40 having straight grains 41 in one direction is formed by extrusion molding. And, as shown in Figure 4B, a contact pin or contact finger 42 in patterns such as "C"-shape or "S"-shape is drawn. And then, as shown in Figure 4C, a pattern shaped in a contact finger is cut out therefrom, to thereby form a contact finger 42.

[0023] In this respect, however, the contact finger made by that method is easily broken along the metal grains during the testing, as up and down movement is repeated by hundreds and thousands of times.

[0024] In addition, the movement in the direction perpendicular to the direction of the metal gain is repeated, its spring elastic force is weakened, so that the contact finger is easily deformed, resulting in that a durability of the socket is shortened.

[0025] US Patent No. 5,742,171 describes a test device for testing a multi-contact integrated circuit. That test device includes a group of four contact pin units housed within a central cavity of a socket base and held in place by an inner frame-type retainer.

DISCLOSURE OF THE INVENTION

[0026] Therefore, it is an object of the present invention to provide a test socket structure in which a contact pin of a defective socket is replaced by block unit.

[0027] Another object of the present invention is to provide a test socket structure in which a pattern of a printed circuit board of a testing equipment is not abraded during testing of a semiconductor device.

[0028] Still another object of the present invention is to provide a test socket in which an elastomer is installed at a portion where an end portion of a contact pin contacts a socket housing so as to successively maintain a spring elastic force at the end portion of the contact pin, thereby lengthening a durability of the contact pin, and height deviation of each contact pin is reduced, so that a reliability in an electrical connection between the contact pin and an outer lead of a device under test is obtained.

[0029] Also, another object of the present invention is to provide a fabricating method for a contact pin for a test socket, so that a socket pin has a strong spring elastic force and is not easily deformed or not easily fatigued.

[0030] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodiment and broadly described herein, there is provided a test socket including: a first housing made of an insulating material having a predetermined thickness; a second housing made of an insulating material, a side wall of which is adjacent to a side wall of the first housing; and a first and a second elastomer respectively installed at an upper and a lower surface of the second housing; wherein the test socket further includes a contact pin block having a plurality of metal pins arranged at constant pitches, the metal pins having grains in a constant direction thereon in the grain direction and being bent in a direction perpendicular to the grain direction, and having an insulating tape attached onto one side or both sides of the metal pins for fixing the plurality of contact pins so that they can be moved together; and wherein the contact pin block is insertedly installed between the first and the second housings and is contacted with the first and the second elastomers in the vicinity of both end portions of the contact pins.

[0031] The first housing of the test socket of the present invention is the insulating material having an opening at its central portion, while the second housing is an insulating plug insertedly installed at the opening of the first housing.

[0032] There is also provided a test socket in accordance with another aspect of the present invention including: a first housing made of an insulating material having a slit a the central portion of its upper surface and a receiving recess at the central portion of its lower surface; a left supporting unit and right supporting unit respectively insertedly installed within the receiving recess of the first housing; a first elastomer protrusively installed both at a side wall of the left supporting unit and at a side wall of the right supporting unit; a left contact pin block supported by the side wall of the left supporting unit; and a right contact pin block supported by the side wall of the right supporting unit; wherein each contact pin block comprises a plurality of metal pins arranged at constant pitches, the metal pins having grains in a constant direction thereon in the grain direction and being bent in a direction perpendicular to the grain direction and having an insulating tape attached onto one side or
both sides of the metal pins; and wherein the left contact pin block and the right contact pin block have respectively at least one bent portion, the contact pins are bent outwardly of each side wall of the left supporting unit and the right supporting unit, and the bent portion of the left contact pin block and that of the right contact pin block are closed to each other.

[0033] In accordance with another aspect of the present invention, there is also provided a method of fabricating a contact pin block of a test socket according to the invention, including the steps of: preparing a metal plate extrusion-molded so as to have grains in a constant direction thereon; cutting the metal plate in the grain direction to form a metal strip; bending or curving the metal strip in a direction perpendicular to the grains to make a contact pin for a socket; and arranging the plurality of contact pins at constant pitches and attaching an insulating tape onto one side or both sides of the contact pins to thereby form a contact block.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034]

Figure 1 is a longitudinal-sectional view of a conventional test socket; Figure 2 shows a device under test mounted on the test socket of Figure 1; Figure 3A is an outer perspective view a test socket in accordance with another embodiment of the conventional art; Figure 3B is a longitudinal-sectional view of the test socket taken along line IV-IV; Figures 4A through 4C sequentially shows the order of fabricating process of a contact pin of a test socket in the conventional art; Figure 5A is an outer perspective view of a test socket in accordance with a first aspect of the present invention; Figure 5B is a longitudinal-sectional view of the test socket taken along line Vb-Vb of Figure 5A in accordance with the present invention; Figure 5C is a disassembled perspective view of the test socket of Figure 5A in accordance with the present invention; Figures 6A through 6C are sectional view showing various modifications of the contact pin for the test socket in accordance with the present invention; Figures 7A and 7B are outer perspective views of a contact pin block in accordance with the present invention; Figures 8A through 8C shows the order of fabricating process of the contact pin for test socket in accordance with the present invention; Figure 9A is a plan view of a test socket in accordance with a second aspect of the present invention; Figure 9B is a longitudinal-sectional view of the test socket taken along line IXb-IXb of Figure 9A in accordance with the present invention; Figure 9C is a sectional view of each element of Figure 9B as disassembled in accordance with the present invention; Figure 10A is a sectional view of test socket in accordance with a second embodiment of the second aspect of the present invention; and Figure 10B is a sectional view of each element of Figure 10A as disassembled in accordance with the present invention.

MODES FOR CARRYING OUT THE PREFERRED EMBODIMENTS

[0035] Various embodiments of socket structures in accordance with the present invention will now be described with reference to the accompanying drawings [0036] A test socket structure for testing a semiconductor device sealed in a package in a QFP (quad flat package) type in accordance with a first aspect of the present invention will now be described with reference to Figures 5A through 5C.

[0037] Figure 5A is an outer perspective view of a test socket in accordance with a first aspect of the present invention; Figure 5B is a longitudinal-sectional view of the test socket taken along line Vb-Vb of Figure 5A in accordance with the present invention; and Figure 5C is a disassembled perspective view of the test socket of Figure 5A in accordance with the present invention.

[0038] A test socket in accordance with a first aspect of the present invention includes a first housing 51 made of an insulating material having an opening 51a at its central portion; and a second housing 52 (or an insulating plug) made of an insulating material insertedly mounted in the opening 51a of the first housing.

[0039] Around the four corners, thread grooves 51b are formed for fixing a socket to a printed circuit board where a test circuit is formed. Since the test socket is directly fixed onto the printed circuit board of a test equipment by using the thread grooves 51b, a lower end portion of a contact pin of the socket and a circuit pattern of the printed circuit board are fixedly attached to each other, having a good reliability in connection and a low contact resistance.

[0040] In addition, unlike in the conventional art, the socket contact pin and the printed circuit board of the test equipment are directly connected without inserting a socket board therebetween, so that an electrical connection path between an outer lead of the device under test and the circuit pattern of the printed circuit board is shortened, which is suitable for testing of a highfrequency semiconductor device. Moreover, during testing, a stability in its connection can be guaranteed even for such a mechanic movement that the package is mounted and dismounted.

[0041] The second housing 52 has a moat-shaped first and second cavities 52a and 52b at its upper and lower surfaces. A first elastomer 53 is insertedly in-
installed at the first cavity 52a, while a second elastomer 54 is insertedly installed at the second cavity 52b.

As shown in the drawings, the second housing 52 is inserted in the opening 51 a of the first housing 51, and the contact pin block 55 is insertedly installed between the first housing 51 and the second housing 52.

The contact pin block 55 includes a plurality of contact pins 55a arranged at constant pitches, and a heat adhesive insulating tape 55b attached on one side or on both sides of each contact pin 55a. The insulating tape 55b serves to maintain the constant pitches between each contact pin, to fix the plurality of contact pins so that they can move together at the same time, and to reduce a height deviation of each contact pin.

Accordingly, as to the test socket in accordance with the present invention, the plurality of contact pins are formed in block, so that the contact pins can be replaced by block when they are possibly defective. Thus, it is much advantageous in that the replacement of the contact pins is easily and speedily made.

In addition, accordingly, only the defective contact pin block is replaced rather than discarding the entire socket, so that its expense can be much saved.

Moreover, since the contact pins are fixed by block at the same pitches by the polyimide tape, not separated by one, the pitches between each individual contact pin need not be adjusted separately one by one.

The contact pin block 55 is bent in 'C'-shaped so as to be contacted with an upper surface, a side wall and a lower surface of the second housing 52. The contact pin block 55 is installed by being simply inserted from the side of the second housing 52, the way like inserting a clip, thus, the replacement of a defective contact pin is quite easy.

The contact pin is changeable in various shapes as shown in Figures 6A through 6C.

First, as shown in Figure 6A, a metal substrate 60 is combined to be connected thereto or the circuit pattern formed on the printed circuit board.

Accordingly, as to the test socket in accordance with the present invention, when the device under test is pressed by the pressing pressure in testing, since the lower end portion of the contact pin and the circuit pattern of the printed circuit board in testing) of the contact pin block in accordance with the present invention, the test socket in accordance with the present invention can be readily applied to various kinds of test equipment having printed circuit boards in different shapes and in different sizes.

As shown in Figures 7A and 7B, as to the contact pin block in accordance with the present invention, an elasticity of the contact pin can be controlled by adjusting the lengths L1 and L2 of the contact pins 71a and 71b exposed outwardly of the insulating tapes 70a and 70b.

In detail, the shorter the lengths L1 and L2 are, the stronger the elasticity (spring elastic force) is, while the longer the lengths L1 and L2 are, the weaker the elasticity is. Accordingly, the width of the insulating tapes 70a and 70b can be controlled to have a suitable elasticity in testing, in consideration of a contact resistance between the external terminal of the device under test and the end portion of the contact pin, the strength of the downward pressure and the electric characteristics of the test circuit.

As shown in Figure 8A, a metal substrate
having metal grains (formed in extrusion) in a constant direction is formed.

[0060] Then, as shown in Figure 8B, the metal substrate 80 having a predetermined width is cut in the grain direction to form a metal strip 82.

[0061] Next, as shown in Figure 8C, the metal strip 82 is bent or curved in the 'f' direction perpendicular to the direction of the metal grain 81 to form a contact pin 83.

[0062] And then, the plurality of contact pins formed by bending or curving the metal strips are arranged at constant pitches and an insulating tape is attached onto one side or onto the both sides thereof, to thereby fabricating the socket pin block to be used for the socket of the present invention.

[0063] As described above, in case that the metal plate is cut in the grain direction of the metal, which is then bent or curved in the direction perpendicular to the grain direction to form the contact pin, deformation or breakdown of the bent or curved form due to fatigue of the material would hardly occur even if the socket contact pin would be used for a long time, so that the durability of the socket pin is prolonged.

[0064] A test socket structure of a multi-chip module device in accordance with a second aspect of the present invention will now be described with reference to Figures 9A through 9C.

[0065] Figure 9A is a plan view of a test socket in accordance with a second aspect of the present invention; Figure 9B is a longitudinal-sectional view of the test socket taken along line IXb-IXb of Figure 9A in accordance with the present invention; and Figure 9C is a sectional view of each element of Figure 9B as disassembled in accordance with the present invention.

[0066] A test socket in accordance with the second aspect of the present invention is applicable in case where the device under test is a multi-chip module. The test socket includes a slit 91 a at the central portion of its upper surface through which an outer lead of the device under test is taken in and drawn out, and a first housing 90 having a receiving recess 91 b where a supporting unit for supporting a contact pin block is mounted at the center thereof. The slit 91 a and the receiving recess 91 b are connected to each other.

[0067] The contact pin supporting unit is inserted by being divided to a left supporting unit 93a and a right supporting unit 93b in the receiving recess 91 b.

[0068] The left and right supporting units 93a and 93b respectively have a slot at a predetermined upper portion where the upper end portion of the contact pin is taken in.

[0069] The left and the right supporting units 93a and 93b are respectively formed with a narrower upper side and wider lower side. As a result, a cavity 99 is formed between the left supporting unit 93a and the right supporting unit 93b at the upper side narrower than the lower side, while the left supporting unit 93a and right supporting unit 93b almost come to contact at the lower side.

[0070] First cavities 94a and 94b are respectively formed at each side wall of the left and the right supporting units 93a and 93b, and first elastomers 95a and 95b are respectively inserted into the first cavities 94a and 94b. The first elastomers 95a and 95b formed protrusive outwardly more than the side wall of the left and right supporting units 93a and 93b.

[0071] Second cavities 96a and 96b are respectively formed at the surface of the left and the right supporting units 93a and 93b, and second elastomers 97a and 97b are respectively inserted into the second cavities 96a and 96b. The second elastomers 97a and 97b are formed protrusive somewhat downwardly from the lower surface of the supporting units.

[0072] Left and right contact pin blocks 98a and 98b are installed between the left and the right supporting units 93a and 93b.

[0073] The left and left contact pin blocks 98a and 98b respectively include a plurality of contact pins 100 arranged at predetermined pitches and an insulating tape 101 attached on one side or both sides of each of the plurality of contact pins 100.

[0074] The plurality of contact pins attached on the insulating tape 101 are made of block so as to be moved together. Accordingly, if some contact pins are defective during the testing, they are replaced by block as attached on the insulating tape 101.

[0075] The end portions of the contact pins 100 are connected by narrow insulating linear tapes 100a, respectively. When the contact pin block having the thin contact pins at narrow pitches is fixed to the left and right supporting units, the linear tapes 100a serve to prevent the pitches between contact pins from widening at the upper end portion of the contact pins, or prevent a short between the contact pins possibly caused when the pitches therebetween become too narrow.

[0076] The upper end portion 102 of the contact pins 100 of the contact pin block is bent in hook shape, and its marginal portion of the upper end portion 102 is inserted into the slot 92 of the left and right supporting units 93a and 93b.

[0077] As the contact pin blocks are mounted at the left and right supporting units and then inserted into the first housing 90, the upper end portion 102 of the contact pins is positioned below the first housing 90. Accordingly, since the upper end portion 102 of the contact pins 100 is positioned inside the housing rather than being exposed outside, the contact pins would be hardly deformed due to any external source when the device under test is taken in and drawn out. Therefore, the durability of the socket contact pin is lengthened.

[0078] Each contact pin 100 is bent at least twice, having a first bent portion 104 and a second bent portion 105. The first bent portion 104 is formed near the upper end portion 102 of the contact pin 100, while the second bent portion 105 is formed near the lower end portion 103 of the contact pin 100. The first bent portion 104 is bent to be convex toward outside of the side wall of the
left and right supporting units, of which vertex is positioned in the central line C-C of the socket, that is, in the same vertical line as the slit.

[0079] The first bent portion 104 of the contact pins of the left contact pin block 98a contacts the first elastomer 95a installed at the left supporting unit 93a, while the first bent portion 104 of the right contact pin block 98b contacts the first elastomer 95b installed at the right supporting unit.

[0080] The first bent portion of the contact pin of the left contact pin block and the first bent portion of the contact pin of the right contact pin block are closed to each other in a facing manner.

[0081] During testing, the outer lead of the device under test is inserted between the first bent portions of the left and right contact pins. In detail, when the outer lead of the device under test is inserted, the left and right contact pin blocks are open as the first bent portion of the left and right contact pin block is pushed outwardly of the central line, and when the outer lead of the device under test is taken out, they are attached.

[0082] Generally, in most cases, as the testing is repeatedly done, the elasticity of the first bent portion is weakened, deteriorating a reliability of the electric connection between the outer lead of the device under test and the contact pin.

[0083] However, according to the above described present invention, since the elastomer is installed between the bent portion of the contact pin block and the side wall of the supporting unit, which prevents an instability in the connection between the outer lead of the device under test and the contact pin normally caused as the elasticity (spring elastic force) at the bent portion of the contact pin becomes weak.

[0084] Also, unlike the point contact method of the conventional art, wider area of the outer lead of the device under test contacts the contact pin, so that the stability in the electric connection between the contact pin and the outer lead is quite improved.

[0085] The second bent portion 105 is formed at a lower corner side of the left and right supporting units 93a and 93b, and the lower end portion 103 of the contact pin is protruded outwardly of the left and right supporting units 93a and 93b.

[0086] The lower end portion 103 of the contact pin 100 is positioned at the lower surface of each of the left and right supporting units 93a and 93b, and specially, contacts the second elastomers 97a and 97b installed at the lower surface of the left and right supporting units 93a and 93b.

[0087] Accordingly, even though up and down movement of the contact pin is repeated while the test is repeatedly done, the elasticity at the portion where the lower end portion 103 contacts the printed circuit of the printed circuit board is constantly maintained. Also, since the height deviation of the lower end portion 103 of the contact pins is even, thereby obtaining a reliability in the connection between the printed circuit and the contact pin.

[0088] The contact pin 100 may form a third bent portion 106 between the first bent portion 104 and the second bent portion 105.

[0089] In testing, the lead pin of the device under test is inserted between the first bent portions 104 of the left and right contact pin blocks 98a and 98b so as to be connected to the contact pins of the socket. At this time, when the device under test is pressed by a downward pressure at the same time when the lead pin of the device under test is inserted between the first bent portions of the left and right contact pin blocks, the lower end portion 103 of the contact pin is connected to the printed circuit of the test equipment.

[0090] Likewise in the first aspect of the present invention, the test socket in accordance with the second aspect of the present invention is advantageous in that since the contact pin is formed in block by attaching the polyimide tape on the plurality of contact pins, when any contact pin of the test socket is defective, it can be easily replaced by block. Also, the elasticity of the contact pin can be readily controlled by changing the length of the contact pin exposed outside of the polyimide tape. In addition, the height deviation between each contact pin can be reduced. Moreover, the elastomers for preventing the elasticity of the contact pin from weakening are provided at the position where the outer lead of the device under test is inserted to be connected, so as to thereby prevent the durability of the contact pin from shortening. Also, in fabricating the contact pin, since the metal plate is cut in the grain direction of the metal and is bent or curved in the direction perpendicular to the grain direction, the spring elastic force of the contact pin is hardly weakened or deformed.

[0091] Figure 10A is a sectional view of test socket in accordance with a second embodiment of the second aspect of the present invention; and Figure 10B is a sectional view of each element of Figure 10A as disassembled in accordance with the present invention.

[0092] A test socket in accordance with a second embodiment of the second aspect of the present invention also has a structure for testing a multi-chip module device. Specially, it is applicable to the case where a board of the test equipment is a vertical-type printed circuit board.

[0093] The test socket of the second embodiment of the second aspect present invention includes a slit 111 a at the central portion of its upper surface, through which an outer lead of a device under test is taken in and drawn out, and a first housing 110 having a receiving recess 111 b at the central portion of its lower surface. The slit 111 a and the receiving recess 111 b are connected to each other.

[0094] A contact pin supporting unit 112 is inserted into the receiving recess 111 b. The contact pin supporting unit 112 is divided to a left supporting unit 112a and right supporting unit 112b, between which a contact pin block is installed.
A test socket comprising:

1. A first housing (51) made of an insulating material having a predetermined thickness and having an opening (51a) at its central portion; a second housing (52; 66) made of an insulating material and insertedly installed at the opening (51a) of the first housing (51) such that...
The test socket according to any one of the preceding claims, characterised in that the contact pins (55a; 61; 61a) of the contact pin block (55) respectively have at least one bent portion (55c; 63) at the part exposed outside of the insulating tape (55b; 62; 62a).

5. The test socket according to claim 4, characterised in that the contact pins (55a; 61; 61a) are installed to contact the first elastomer (53; 64) or the second elastomer (54; 65) in the vicinity of the bent portion (55c; 63).

6. The test socket according to any one of the preceding claims, characterised in that each contact pin (55a; 61; 61a) in the contact pin block (55) is formed from a metal strip (82) having grains (81) extending in a direction along the length of the strip, which strip (82) is bent or curved in a direction perpendicular to the grains (81).

7. A test socket comprising:

- a first housing (90; 110) made of an insulating material having a slit (91a; 111a) at the central portion of its upper surface and a receiving recess (91b; 111b) at the central portion of its lower surface;
- a left supporting unit (93a; 112a) and right supporting unit (93b; 112b) respectively insertedly installed within the receiving recess (91b; 111b) of the first housing (90; 110);
- a first elastomer (95a, 95b; 115) protrusively installed both at a side wall of the left supporting unit (93a; 112a) and at a side wall of the right supporting unit (93b; 112b);
- a left contact pin block (98a; 117) supported by the side wall of the left supporting unit; and
- a right contact pin block (98b; 118) supported by the side wall of the right supporting unit;

wherein each contact pin block (98a, 98b; 117, 118) comprises a plurality of metal pins (101; 120) arranged at constant pitches, the metal pins (101; 120) having grains in a constant direction thereon in the grain direction and being bent in a direction perpendicular to the grain direction, and having an insulating tape (100; 121) attached onto one side or both sides of the metal pins (101; 120), and in that the contact pin block (98a; 117) and the contact pin block (98b; 118) have respectively at least one bent portion (104), the contact pins being bent outwardly of each side wall of the left supporting unit (93a; 112a) and the right supporting unit (93b; 112b), and the bent portion (104) of the left contact pin block (98a; 117) and that of the right contact pin block (98b; 118) are closed to each other.

8. The test socket according to claim 7, characterised in that the first elastomer (95a, 95b; 115) is positioned between the side wall of the left side supporting unit (93a; 112a) and the bent portion (104) of the left side contact pin block (98a; 117), and between the side wall of the right supporting unit (93b; 112b) and the bent portion (104) of the right contact pin block (98b; 118).

9. The test socket according to claim 7 or claim 8, characterised in that a cavity (96a, 96b) is formed at a lower surface of the left and right supporting units (93a, 93b), a second elastomer is inserted in the cavity (96a, 96b), and a lower end portion (105) of the contact pins (101) of the contact pin blocks (98a, 98b) contacts the second elastomer.

10. The test socket according to any one of claims 7 to 9, characterised in that a slot (92) is formed on the upper surface of each of the left and right supporting
units (93a, 93b; 112a, 112b), and a marginal portion of the contact pins (101; 120) is positioned inside the slot (92).

11. The test socket according to any one of claims 7 to 10, characterised in that the marginal portions of the contact pins (101; 120) are connected by an insulating linear tape (100a; 120a).

12. The test socket according to any one of claims 7 to 11, characterised in that each contact pin (101; 120) in the contact pin blocks (98a, 98b; 117, 118) is formed from a metal strip (82) having grains (81) extending in a direction along the length of the strip, which strip (82) is bent or curved in a direction perpendicular to the grains (81).

13. The test socket according to claim 9, characterised in that the first elastomers (115) and second elastomers (116) are respectively protrusively installed at an upper side and a lower side of each side wall of the left and right supporting units (112a, 112b) at a predetermined interval; and in that the left contact block (117) and the right contact block (118) have two convex bent portions formed convexly in the distanced direction from the side wall and a concave bent portion formed between the convex bent portions and bent in the adjacent direction to the side wall of the supporting unit (112a, 112b), and each convex bent portion of the right contact pin block (118) and the left contact pin block (117) closes to each other.

14. The test socket according to claim 13, characterised in that the convex bent portion contacts the first elastomer (115) or the second elastomer (116).

15. The test socket according to claim 13 or claim 14, characterised in that an insulating spacer (119) is installed between the left contact pin block (117) and the right contact pin block (118) at the concave bent portion.

16. The test socket according to any one of claims 13 to 15, characterised in that marginal portions of the contact pins are connected by an insulating linear tape.

17. A method of fabricating contact pins (55a; 61; 61a; 101; 120) for the contact pin blocks (55; 98a, 98b; 117, 118) of a test socket according to any one of the preceding claims, the method characterised by the steps of:

- preparing a metal plate (80) extrusion-molded so as to have grains (81) in a constant direction thereon;
- cutting the metal plate (80) in the grain direction to form a metal strip (82);
- bending or curving the metal strip (82) in a direction perpendicular to the grains (81) to make a contact pin (83) for socket; and
- arranging the plurality of contact pins (83) at constant pitches and attaching an insulating tape (55b; 70a, 70b; 100; 121) onto one side or both sides of the contact pins (83) to thereby form a contact block (55; 98a, 98b; 117, 118).

**Patentansprüche**

1. Prüfbuchse, aufweisend:

- ein erstes Gehäuse (51) aus einem isolierenden Material mit einer vorgegebenen Dicke und mit einer Öffnung (51a) in seinem zentralen Abschnitt;
- ein zweites Gehäuse (52; 66) aus einem isolierenden Material, das durch Einführen in die Öffnung (51a) des ersten Gehäuses (51) so installiert wird, dass entsprechende Seitenwände des ersten Gehäuses und des zweiten Gehäuses nebeneinander liegen; und
- ein erstes und ein zweites Elastomer (53, 54; 64, 65), die jeweils an einer oberen und einer unteren Oberfläche (52a, 52b) des zweiten Gehäuses (52; 66) angebracht sind;

**dadurch gekennzeichnet, dass** die Prüfbuchse ferner einen Kontaktstiftblock (55) mit einer Mehrzahl Metallstifte (55a; 61; 61a) aufweist, die in konstanten Abständen angeordnet sind, wobei die Metallstifte (55a) eine Körnung in konstanter Richtung auf ihrer Oberfläche haben und senkrecht zur Richtung der Körnung gebogen sind, und wobei ein Isolierband (55b; 62; 62a) an einer oder beiden Seiten der Metallstifte angebracht ist, um die Mehrzahl der Stifte (55a; 61; 61a) zu fixieren, so dass sie sich zusammen bewegen können; und dass der Kontaktstiftblock (55) zwischen dem ersten und zweiten Gehäuse (51, 52; 66) installiert ist und mit dem ersten und zweiten Elastomer (53, 54; 64, 65) in der Nähe beider Endabschnitte (55c; 63) der Kontaktstifte (55a; 61; 61a) in Berührung steht.

2. Prüfbuchse nach Anspruch 1, **dadurch gekennzeichnet, dass** der Kontaktstiftblock (55) in C-Form gebogen und so in das erste Gehäuse (51) einge führt ist, dass er die obere Oberfläche, die Seitenfläche und die untere Oberfläche des ersten Gehäuses (51) berührt.

3. Prüfbuchse nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** die Längen (L1; L2) jedes Kontaktstiftes (55a; 61; 61a), die außerhalb des Isolierbandes (55b; 62; 62a) des Kontaktstift-
blocks (55) freiliegen, gerade sind.

4. Prüfbuchse nach einem der vorigen Ansprüche, **dadurch gekennzeichnet, dass** die Kontaktstifte (55a; 61; 61a) des Kontaktstiftblocks (55) jeweils mindestens einen gebogenen Abschnitt (55c; 63) an dem außerhalb des Isolierbandes (55b; 62; 62a) freiliegenden Abschnitt haben.

5. Prüfbuchse nach Anspruch 4, **dadurch gekennzeichnet, dass** die Kontaktstifte (55a; 61; 61a) so installiert sind, dass sie das erste Elastomer (53; 64) oder das zweite Elastomer (54; 65) in der Nähe des gebogenen Abschnitts (55c; 63) berühren.

6. Prüfbuchse nach einem der vorigen Ansprüche, **dadurch gekennzeichnet, dass** jeder Kontaktstift (55a; 61; 61a) im Kontaktstiftblock (55) aus einem Metallstreifen (82) mit Körnern (81) geformt ist, die sich in Richtung entlang der Länge des Streifens erstrecken, wobei der Streifen (82) in Richtung senkrecht zur Körnung (81) gebogen oder gekrümmt ist.

7. Prüfbuchse, aufweisend:

   ein erstes Gehäuse (90; 110) aus einem isolierenden Material mit einem Schlitz (91a; 111a) im zentralen Abschnitt seiner oberen Oberfläche und einer Aufnahmehalbierung (91b; 111b) im zentralen Abschnitt seiner unteren Oberfläche;

   eine linke Stützeinheit (93a; 112a) und eine rechte Stützeinheit (93b; 112b), die jeweils durch Einführen in der Aufnahmehalbierung (91b; 111b) des ersten Gehäuses (90; 110) installiert sind;

   ein erstes Elastomer (95a, 95b; 115), das hervorstehend sowohl an einer Seitenwand der linken Stützeinheit (93a; 112a) als auch an einer Seitenwand der rechten Stützeinheit (93b; 112b) angebracht ist;

   einen linken Kontaktstiftblock (98a; 117), der von der Seitenwand der linken Stützeinheit gestützt wird; und

   einen rechten Kontaktstiftblock (98b; 118), der von der Seitenwand der linken Stützeinheit gestützt wird;

   bei der jeder Kontaktstiftblock (98a, 98b; 117, 118) eine Mehrzahl Metallstifte (101; 120) aufweist, die in konstanten Abständen angeordnet sind, wobei die Metallstifte (101; 120) eine Körnung in konstanter Richtung darauf in Richtung der Körnung haben und senkrecht zur Richtung der Körnung gebogen sind, und ein Isolierband (100; 121) haben, das an einer oder beiden Seiten der Metallstifte (101; 120) angebracht ist, und bei der linke Kontaktstiftblock (98a; 117) und der rechte Kontaktstiftblock (98b; 118) jeweils mindestens einen gebogenen Abschnitt (104) haben, wobei die Kontaktstifte von jeder Seitenwand der linken Stützeinheit (93a; 112a) und der rechten Stützeinheit (93b; 112b) aus nach außen gebogen sind und der gebogene Abschnitt (104) des linken Kontaktstiftblocks (98a; 117) und des rechten Kontaktstiftblocks (98b; 118) zueinander geschlossen sind.

8. Prüfbuchse nach Anspruch 7, **dadurch gekennzeichnet, dass** das erste Elastomer (95a, 95b; 115) zwischen der Seitenwand der linken Stützeinheit (93a; 112a) und dem gebogenen Abschnitt (104) des linken Kontaktstiftblocks (98a; 117) und zwischen der Seitenwand der rechten Stützeinheit (93b; 112b) und dem gebogenen Abschnitt (104) des rechten Kontaktstiftblocks (98b; 118) angeordnet ist.

9. Prüfbuchse nach Anspruch 7 oder Anspruch 8, **dadurch gekennzeichnet, dass** ein Hohlraum (96a, 96b) in einer unteren Oberfläche der linken und rechten Stützeinheit (93a, 93b) ausgerichtet ist, ein zweites Elastomer in den Hohlraum (96a, 96b) eingeführt ist und ein unterer Endabschnitt (105) der Kontaktstifte (101) des Kontaktstiftblocks (98a, 98b) das zweite Elastomer berührt.

10. Prüfbuchse nach einem der Ansprüche 7 bis 9, **dadurch gekennzeichnet, dass** ein Schlitz (92) in der oberen Oberfläche jeder der linken und rechten Stützeinheiten (93a, 93b) ausgeformt ist und ein Endabschnitt der Kontaktstifte (101; 120) im Innern des Schlitzes (92) positioniert ist.

11. Prüfbuchse nach einem der Ansprüche 7 bis 10, **dadurch gekennzeichnet, dass** die Endabschnitte der Kontaktstifte (101; 120) durch ein lineares Isolierband (100a; 120a) verbunden sind.

12. Prüfbuchse nach einem der Ansprüche 7 bis 11, **dadurch gekennzeichnet, dass** jeder Kontaktstift (101; 120) in den Kontaktstiftblöcken (98a, 98b; 117, 118) aus einem Metallstreifen (82) mit Körnern (81) geformt ist, die sich in Richtung entlang der Länge des Streifens erstrecken, wobei der Streifen (82) in Richtung senkrecht zur Körnung (81) gebogen oder gekrümmt ist.

13. Prüfbuchse nach Anspruch 9, **dadurch gekennzeichnet, dass** die ersten Elastomere (115) und die zweiten Elastomere (116) jeweils hervorstehend an der oberen Seite und der unteren Seite jeder Seitenwand der linken und rechten Stützeinheiten (112a, 112b) in einem vorgegebenen Abstand angeordnet sind; und dass der linke Kontaktblock (117) und der rech-
te Kontaktblock (118) zwei konvex gebogene Abschnitte haben, die konvex in Abstandsrichtung von der Seitenwand gebogen sind, und einen konkav gebogenen Abschnitt, der zwischen den konvex gebogenen Abschnitten ausgeformt und in der be nachbarten Richtung zur Seitenwand der Stützeinheit 112a, 112b) gebogen ist, und jeder konvex gebogene Abschnitt des rechten Kontaktstiftblocks (118) und des linken Kontaktstiftblocks (117) zueinander geschlossen ist.


15. Prüfbuchse nach Anspruch 13 oder Anspruch 14, dadurch gekennzeichnet, dass ein isolierendes Abstandsstück (119) zwischen dem linken Kontaktstiftblock (117) und dem rechten Kontaktstiftblock (118) am konkav gebogenen Abschnitt angeordnet ist.

16. Prüfbuchse nach einem der Ansprüche 13 bis 15, dadurch gekennzeichnet, dass die Endabschnitte der Kontaktstifte durch ein lineares Isolierband verbunden sind.

17. Verfahren zur Herstellung von Kontaktstiften (55a; 61; 61a; 101; 120) für die Kontaktstiftblöcke (55; 98a, 98b; 117, 118) einer Prüfbuchse gemäß einem der vorigen Ansprüche, wobei das Verfahren gekennzeichnet ist durch die Schritte:

Behandeln einer stranggepressten Metallplatte (80) auf eine solche Weise, dass sie Körner (81) in einer konstanten Richtung darauf hat;
Schneiden der Metallplatte (80) in Kornrichtung, um einen Metallstreifen (82) zu bilden;
Biegen oder Krümmen des Metallstreifens (82) senkrecht zur Körnung (81), um einen Kontaktstift (83) für die Buchse herzustellen; und
Anordnen der Mehrzahl Kontaktstifte (83) in konstanten Abständen und Anbringen eines Isolierbandes (55b; 70a, 70b; 100; 121) auf einer oder beiden Seiten der Kontaktstifte (83), um dadurch einen Kontaktblock (55; 98a, 98b; 117, 118) zu bilden.

Revendications

1. Embase de test comprenant :

un premier boîtier (51) constitué d’un matériau isolant et placé par insertion à l’ouverture (51a) du premier boîtier (51), de sorte que les parois latérales respectives du premier boîtier et du deuxième boîtier soient adjacentes les unes vis-à-vis des autres ; et
un premier et un deuxième élastomères (53, 54 ; 64, 65) installés respectivement à une surface supérieure et une surface inférieure (52a, 52b) du deuxième boîtier (52 ; 66) ;
caractérisée en ce que l’embase de test comprend en outre un bloc (55) de broches de contact comportant une pluralité de broches métalliques (55a ; 61 ; 61a) disposées selon des pas constants, les broches métalliques (55a) comportant des grains dans une direction constante sur celles-ci dans la direction des grains et étant recourbées dans une direction perpendiculaire à la direction des grains, et comportant un ruban isolant (55b ; 62 ; 62a) fixé sur un côté ou sur les deux côtés des broches métalliques, destiné à fixer la pluralité de broches (55a ; 61 ; 61a) de manière à ce qu’elles puissent se déplacer ensemble ;
et en ce que le bloc (55) de broches de contact est installé entre les premier et deuxième boîtiers (51, 52 ; 66) et est en contact le premier et le deuxième élastomères (53, 54 ; 64, 65) dans le voisinage des deux parties d’extrémité (55c ; 63) des broches de contact (55a ; 61 ; 61a).

2. Embase de test selon la revendication 1, caractérisée en ce que le bloc (55) de broches de contact est recourbé en forme de "C" et inséré dans le premier boîtier (51) de manière à être en contact avec la surface supérieure, le côté et la surface inférieure du premier boîtier (51).

3. Embase de test selon la revendication 1 ou la revendication 2, caractérisée en ce que les longueurs (L1 ; L2) de chaque pointe de contact (55a ; 61 ; 61a) exposées à l’extérieur du ruban isolant (55b ; 62 ; 62a) du bloc (55) de broches de contact sont égales.

4. Embase de test selon l’une quelconque des revendications précédentes, caractérisée en ce que les broches de contact (55a ; 61 ; 61a) du bloc (55) de broches de contact comportent respectivement au moins une partie recourbée (55c ; 63) à la partie exposée à l’extérieur du ruban isolant (55b ; 62 ; 62a).

5. Embase de test selon la revendication 4, caractérisée en ce que les broches de contact (55a ; 61 ; 61a) sont installées de manière à être en contact avec le premier élastomère (53 ; 64) ou le deuxième élastomère (54 ; 65) dans le voisinage de
la partie recourbée (55c ; 63).

6. Embase de test selon l'une quelconque des revendications précédentes, caractérisée en ce que chaque pointe de contact (55a ; 61 ; 61a) dans le bloc (55) de broches de contact est constituée à partir d'une bande de métal (82) comportant des grains (81) se développant dans une direction selon la longueur de la bande, laquelle bande (82) est recourbée ou incurvée dans une direction perpendiculaire aux grains (81).

7. Embase de test comprenant :

- un premier boîtier (90 ; 110) constitué d'un matériau isolant comprenant une fente (91a ; 111a) à la partie centrale de sa surface supérieure et un évidement de réception (91b ; 111b) à la partie centrale de sa surface inférieure ;
- une unité de support gauche (93a ; 112a) et une unité de support droit (93b ; 112b) installées respectivement par insertion dans l'évidement de réception (91b ; 111b) du premier boîtier (90 ; 110) ;
- un premier élastomère (95a, 95b ; 115) installé en saillie à la fois à une paroi latérale de l'unité de support gauche (93a ; 112a) et à une paroi latérale de l'unité de support droit (93b ; 112b) ;
- un bloc gauche (98a ; 117) de broches de contact, porté par la paroi latérale de l'unité de support gauche ; et
- un bloc droit (98b ; 118) de broches de contact, porté par la paroi latérale de l'unité de support droit ;

dans laquelle chaque bloc (98a, 98b ; 117, 118) de broches de contact comprend une pluralité de broches métalliques (101 ; 120) disposées selon des pas constants, les broches métalliques (101 ; 120) comportant des grains dans une direction constante sur celles-ci dans la direction des grains et étant recourbées dans une direction perpendiculaire à la direction des grains, et comportant un ruban isolant (100 ; 121) fixé sur un côté ou sur les deux côtés des broches métalliques (101 ; 120),

et en ce que le bloc gauche (98a ; 117) de broches de contacts et le bloc droit (98b ; 118) de broches de contacts comportent respectivement au moins une partie recourbée (104), les broches de contact étant recourbées vers l'extérieur de chaque paroi latérale de l'unité de support gauche (93a ; 112a) et de l'unité de support droit (93b ; 112b), et la partie recourbée (104) du bloc gauche (98a ; 117) de broches de contact et celle du bloc droit (98b ; 118) de broches de contact sont fermées l'une vis-à-vis de l'autre.

8. Embase de test selon la revendication 7, caractérisée en ce que le premier élastomère (95a, 95b ; 115) est positionné entre la paroi latérale de l'unité de support de côté gauche (93a ; 112a) et la partie recourbée (104) du bloc de côté gauche (98a ; 117) de broches de contact, et entre la paroi latérale de l'unité de support de côté droit (93b ; 112b) et la partie recourbée (104) du bloc de côté droit (98b ; 118) de broches de contact.

9. Embase de test selon la revendication 7 ou la revendication 8, caractérisée en ce qu'une cavité (96a, 96b) est formée à une surface inférieure des unités de support gauche et droite (93a, 93b), un deuxième élastomère est inséré dans la cavité (96a, 96b), et une partie d'extrémité inférieure (105) des broches de contact (101) des blocs (98a, 98b) de broches de contact est en contact avec le deuxième élastomère.

10. Embase de test selon l'une quelconque des revendications 7 à 9, caractérisée en ce qu'une encoche (92) est formée sur la surface supérieure de chacune des unités de support gauche et droite (93a, 93b ; 112a, 112b), et qu'une partie marginale des broches de contact (101 ; 120) est positionnée dans l'encoche (92).

11. Embase de test selon l'une quelconque des revendications 7 à 10, caractérisée en ce que les parties marginales des broches de contact (101 ; 120) sont reliées par un ruban isolant linéaire (100a ; 120a).

12. Embase de test selon l'une quelconque des revendications 7 à 11, caractérisée en ce que chaque pointe de contact (101 ; 120) dans les blocs (98a, 98b ; 117, 118) de broches de contact est constituée à partir d'une bande de métal (82) comportant des grains (81) se développant dans une direction selon la longueur de la bande, laquelle bande (82) est recourbée ou incurvée dans une direction perpendiculaire aux grains (81).

13. Embase de test selon la revendication 9, caractérisée en ce que les premiers élastomères (115) et les deuxième élastomères (116) sont respectivement installés en saillie à un côté supérieur et à un côté inférieur de chaque paroi latérale des unités de support gauche et droit (112a, 112b) selon un intervalle prédéterminé ; et en ce que le bloc gauche (117) de contacts et le bloc droit (118) de contacts comportent deux parties recourbées convexes, constituées de façon converge dans la direction s'éloignant de la paroi latérale,
et une partie recourbée concave, constituée entre les parties recourbées convexes et recourbée dans la direction adjacente à la paroi latérale de l'unité de support (112a, 112b), et chaque partie recourbée convexe du bloc droit (118) de broches de contact et du bloc gauche (117) de broches de contact est fermée vis-à-vis de l'autre.

14. Embase de test selon la revendication 13, caractérisée en ce que la partie recourbée convexe vient en contact avec le premier élastomère (115) ou le deuxième élastomère (116).

15. Embase de test selon la revendication 13 ou la revendication 14, caractérisée en ce qu'une entretoise d'isolation (119) est installée entre le bloc gauche (117) de broches de contact et le bloc droit (118) de broches de contact à la partie recourbée concave.

16. Embase de test selon l'une quelconque des revendications 13 à 15, caractérisée en ce que les parties marginales des broches de contact sont reliés par un ruban isolant linéaire.

17. Procédé de fabrication de broches de contact (55a ; 61 ; 61a ; 101 ; 120) destinées aux blocs (55 ; 98a ; 98b ; 117, 118) de broches de contact d'une embase de test selon l'une quelconque des revendications précédentes, le procédé étant caractérisé par les étapes consistant à :

préparer une plaque de métal (80) moulée par extrusion de manière à comporter des grains (81) dans une direction constante sur celle-ci ;
découper la plaque de métal (80) dans la direction des grains de manière à constituer une bande de métal (82) ;
recourber ou incurver la plaque de métal (80) dans une direction perpendiculaire aux grains de manière à fabriquer une pointe de contact pour l'embase ; et
disposer la pluralité de broches de contact (83) selon des pas constants et fixer un ruban isolant (55b ; 70a, 70b ; 100 ; 121) sur un côté ou sur les deux côtés des broches de contact (83) de façon à constituer ainsi un bloc (55 ; 98a, 98b ; 117, 118) de contact.