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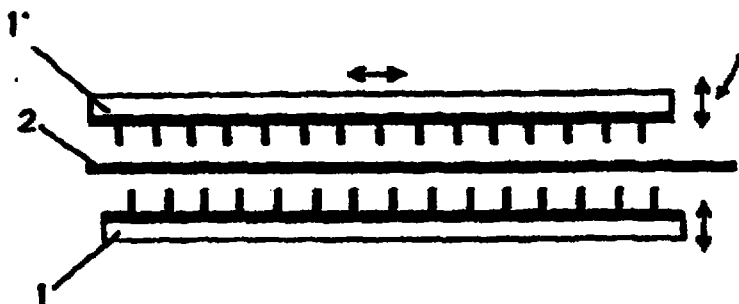
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/IT96/00090 (22) International Filing Date: 3 May 1996 (03.05.96) (30) Priority Data: UD95A000181 22 September 1995 (22.09.95) IT (71) Applicant (for all designated States except US): NEW SYSTEM S.R.L. [IT/IT]; Via III Armata, 131, I-34170 Gorizia (IT). (72) Inventors; and (75) Inventors/Applicants (for US only): VODOPIVEC, Jozef [IT/IT]; Via III Armata, 131, I-34170 Gorizia (IT). FUMO, Cesare [IT/IT]; Via III Armata, 131, I-34170 Gorizia (IT). (74) Agent: D'AGOSTINI, Giovanni; D'Agostini Organizzazione, Via G. Giusti, 17, I-33100 Udine (IT).	(81) Designated States: AU, BR, CA, CN, CZ, FI, HU, JP, KR, MX, NO, NZ, PL, RO, RU, SG, SI, TR, UA, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>	

(54) Title: MACHINE FOR THE OPPOSITE CONTROL OF PRINTED CIRCUITS

(57) Abstract

The object of the invention is to provide a machine for the control of printed circuits, of the type comprising a board bearing (1) a plurality of conductive needles that are connectable on their reverse side to analysis means of the electric parameters between one and the other needle, characterized in that: are used two needle boards, one opposite to the other (1, 1') and between them is positioned for the analysis the respective printed circuit card (2); and, one board is made movable respect to the other; the needles are axially movable.





1 DESCRIPTION

2 MACHINE FOR THE OPPOSITE CONTROL OF PRINTED CIRCUITS

3 Technical Field

4 This invention has as object a machine for the opposite control of
5 printed circuits .

6 The invention finds particular even if not exclusive application in
7 the sector of the control of the printed circuit cards.

8 Background Art

9 In prior art machines for the control of the printed circuits are
10 known.

11 These machines generally consist of a board or bed bearing a
12 plurality of electrically conductive needles, on which must be
13 disposed the card with the printed circuit and by activating
14 properly the electric conductivity among the different needles and
15 by making the respective measurements it is possible to check whether
16 the printed circuit has defects.

17 Obviously for such control it is necessary for the needles to contact
18 the printed circuit in the proper position.

19 As the printed circuits are very different, it results necessary to
20 apply over the needle base board, an adaptation board that
21 comprises the same needles but displaced in a different way in
22 conformity with the printed circuit to be controlled.

23 The drawback of this solution is the limitation of the machine and
24 the possibility to control only the printed circuits that have at
25 disposal corresponding adapters or adaptation boards.

26 Needing as many adaptation boards as are the cards with different
27 printed circuits to be controlled.

28 Furthermore it is known that the layers of the circuits are not



1 always coplanar, wherefore a suitable electric conduction for an
2 effective contact is not always ensured.

3 Disclosure of Invention

4 The purpose of the present invention is that to obviate the above-
5 mentioned drawbacks, and in particular to allow the making of a
6 universal machine able to control the printed circuits, that is
7 having a system of conductive detection needles that can be adapted
8 to any type of circuit .

9 This and other purposes as claimed are obtained by means of
10 a machine for the control of printed circuits, of the type comprising
11 a board bearing a plurality of conductive needles that are
12 connectable on their reverse side to means for the analysis of the
13 electric parameters between one and the other needle, characterized
14 in that:

- 15 - are used two needle boards, one opposite to the other and in
16 between is positioned for the analysis the respective printed circuit
17 card, and,
18 - one board is made movable respect to the other.

19 In this way it is obtained the immediate advantage of
20 simplifying all the system by making universal the application of
21 the machine on different printed circuits without needing adapters.
22 In fact by this it is possible to activate a board needle in any leading
23 end circuit position and to activate an opposite needle of the opposite
24 board, which thanks to the movability of the same board will be able
25 to reach any definite circuit end point to be tested independently
26 from its position, place and shape.

27 In this way the universalization of the testing system for any card is
28 ensured.

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1 Advantageously the machine has also the characteristic that
2 the detection needles are axially movable.

3 In this way, among a plurality of needles it is possible to make
4 interact only some of them, centring more easily the desired
5 positions of the printed circuit.

6 Further advantage derives from that with the axial movability of the
7 needles it is possible to contact better the respective desired points
8 of the circuit even when the card or the layer of the circuit is not
9 perfectly on the same plane in all its points.

10 Advantageously the needles are made axially movable by
11 electromagnetic means.

12 In this way the desired needle is operated in a simple and safe way.

13 These and other advantages will be shown by the following
14 description of embodiment preferred solutions with the help of the
15 included drawings whose details are not to be considered limitative
16 but only given as an example.

17 Figure 1 is a perspective schematic view of a detection board (bed);

18 Figure 2 is a cross-sectional schematic view of an axially movable
19 detection needle.

20 Figure 3 is a cross-sectional view of the preferred embodiment with
21 two opposite detection boards movable one respect to the other and
22 with the card to be controlled placed between them.

23 In particular in the figures the two detection testing boards are
24 indicated with 1 and 1'.

25 Each board has a plurality of needles axially movable 10 by
26 electromagnet 11.

27 Each needle is electrically connected to a known art electric
28 parameters control system 12.

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1 The opposite boards as mentioned are movable one respect to the
2 other for the operative positioning.
3 The card positioned between these is indicated with 2.
4 The system provides a control by a net list "net-list" with relative
5 positions of single points.
6 The connection test is carried out from point to point, so that for
7 testing the connections of a net made of n points, are necessary n-1
8 tests between pairs of points selected in such a way to cover all the
9 connections.
10 The test on short circuits among different nets, is made by selecting
11 a point out of each pair of nets.
12 The maximum number for testing (testing) n nets in this way, is
13 calculated with the following formula:
14 $n*(n-1)/2$.
15 This number can be reduced by selecting only alongside nets, that is
16 the ones close to each other in a pre-determined distance.
17 The positions to be tested are underdivided in sectors corresponding
18 to the number of needles in the movable board (bed), so that the
19 point to be tested is reachable with the position and with one of the
20 testing needles.
21 After the points to be tested are reached, it is necessary to check the
22 connection or insulation.
23 To shorten the time used for the movements, it is possible to optimize
24 the paths of the axes, by modifying the frequency of the single tests.
25 The machine is made up of a frame on which are fixed two opposite
26 boards and independently, movable respect to the two orthogonal
27 axes.
28 On the boards are fixed the testing sounds (needles) directly



- 1 operated by electromagnet in their axial movement.
- 2 At the beginning, the printed circuit is placed on a bearing frame
- 3 that transports it between the two boards.
- 4 In this position the card remains fixed.
- 5 The boards are put close to the card and the test begins.
- 6 Each board is independently controlled and operated, so that the
- 7 maximum stroke necessary is defined by the distance among the
- 8 sounds.
- 9 In correct position, the electromagnet operates the sound on the
- 10 surface to be contacted and thus by a pair of sounds simultaneously
- 11 operated is controlled the functionality of the circuit among the two
- 12 desired points, the respective continuity and eventual short circuits.
- 13 The process proceeds by points in repetitive way as desired.
- 14 Advantageously also the card bearing may be moved respect to one
- 15 or the other board.
- 16 In this way is obtained a wider universalization of use .

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1 Claims

2 1. Machine for the control of printed circuits, of the type
3 comprising a board bearing (1) a plurality of conductive needles
4 (10) that are connectable on their reverse side to analysis means of
5 the electric parameters (12) between one and the other needle,
6 characterized in that:

7 - are used two needle boards (1,1'), one opposing the other and
8 between them is placed for the analysis the respective printed
9 circuit board to be controlled (2), and,

10 - one board is made movable respect to the other at least on the
11 respective planes.

12 2. Machine according to claim 1, characterized in that the respective
13 card bearing (2) is movable respect to one or the other board.

14 3. Machine according to anyone of the previous claims,
15 characterized in that said needles (10) are made axially movable.

16 4. Machine according to previous claim, characterized in that the
17 movability of said needles is obtained by electromagnetic means
18 (11).

19 5. Machine according to any of the previous claims, characterized in
20 that it is made in such a way to operate in the testing between two
21 points of a circuit acting on one side with a needle of one board and
22 on the other side with a needle of the opposite board, after having
23 carried out a respective centring movement of the one respect to the
24 other and/or of both respect to the card circuit.



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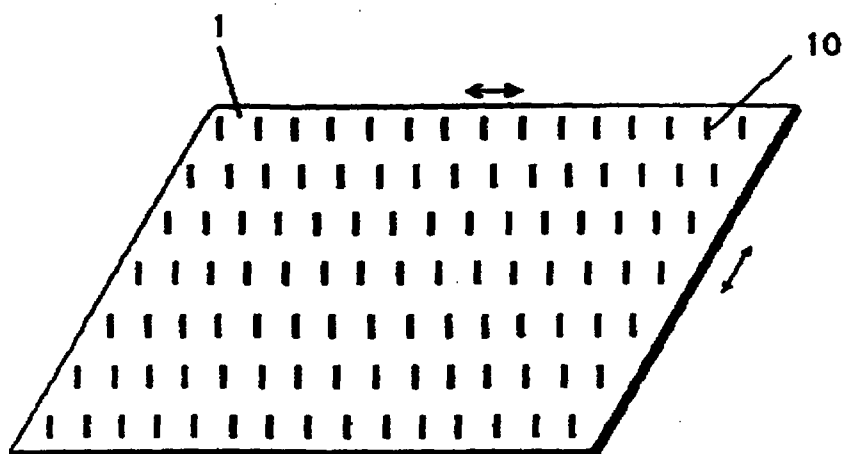


FIG. 1

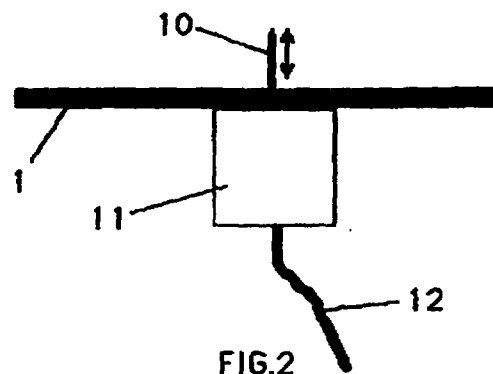


FIG. 2

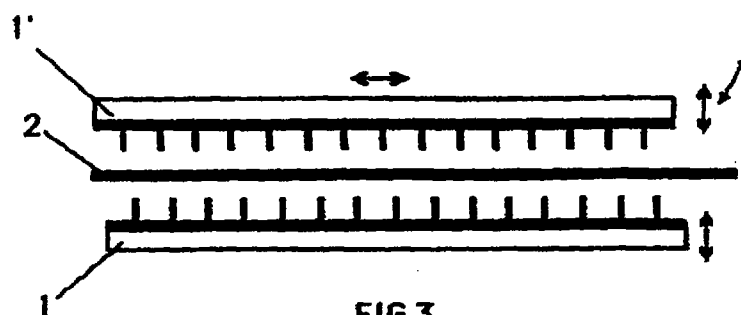


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1 DESCRIPTION

2 MACHINE FOR THE OPPOSITE CONTROL OF PRINTED CIRCUITS

3 Technical Field

4 This invention has as object a machine for the opposite control of
5 printed circuits .

6 The invention finds particular even if not exclusive application in
7 the sector of the control of the printed circuit cards.

8 Background Art

9 In prior art machines for the control of the printed circuits are
10 known.

11 These machines generally consist of a board or bed bearing a
12 plurality of electrically conductive needles, on which must be
13 disposed the card with the printed circuit and by activating
14 properly the electric conductivity among the different needles and
15 by making the respective measurings it is possible to check whether
16 the printed circuit has defects.

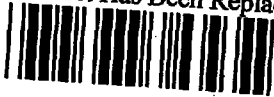
17 Obviously for such control it is necessary for the needles to contact
18 the printed circuit in the proper position.

19 As the printed circuits are very different, it results necessary to
20 apply over the needle base board, an adaptation board that
21 comprises the same needles but displaced in a different way in
22 conformity with the printed circuit to be controlled.

23 The drawback of this solution is the limitation of the machine and
24 the possibility to control only the printed circuits that have at
25 disposal corresponding adapters or adaptation boards.

26 Needing as many adaptation boards as are the cards with different
27 printed circuits to be controlled.

28 Furthermore it is known that the layers of the circuits are not



1 always coplanar, wherefore a suitable electric conduction for an
2 effective contact is not always ensured.

3 EP,A,0 164 722 (Black) 18 December 1985 discloses: an
4 automatic test system for testing printed circuit boards (cards) in
5 which:

6 In this document prior art is cited:

7 - use of a "bed of nails" (bed or plate or board of needles), in which
8 each nail or needle is fixedly placed in said bed or plate or board.

9 In this solution the "bed of nails" has the nail position absolutely
10 fixed and corresponding to the specific pattern of the printed card
11 to be tested.

12 Drawback of this solution is the requirement of as many "beds of
13 nails" as the different printed circuit cards to be tested.

14 - use of a universal grid matrix having a maximum possibility of
15 positionally fixed needles (nails) and a computer program to activate
16 only the required needles (nails) at a time. The programming being
17 dependant on the pattern of the printed card to be tested.

18 This solution has the drawback of continuously reprogramming the
19 machine. Furthermore, because the contact nails or needles are
20 bulky, it is impossible to cover all kinds of patterns.

21 This problem is avoided rendering displaceable along the coordinate
22 axis said contact needles or nails.

23 Nevertheless this solution requires a very complicated and
24 expensive construction of the testing machine and in this case the
25 needles or nails cannot be placed closely one next to the other.

26 Furthermore a continuous reprogramming is required to move one
27 needle or nail in respect to the other.

28 Finally, EP,A,0 164 722 discloses its claimed solution, in which there



1 is a magazine for temporarily storing a plurality of probes (nails or
2 needles) and a base receiver member positioned adjacent to the test
3 head (bed or plate) on one side thereof and in a position to contact
4 the base of each probe. The test head (bed or plate) is adapted to
5 receive the probes and position the probes in a pattern matching
6 test points on the printed circuit board. Means are provided for
7 supporting the test head adjacent to the magazine and in a position
8 to receive probes (nails or needles) from the magazine. Means are
9 also provided for transferring selected ones of the probes from the
10 magazine to the test head.

11 The probes (nails or needles) are for this purpose, movable axially
12 from inside the said test head to the outside or vice versa and some
13 of these further axially moved in order to allow contact with the
14 printed circuit of the card to be tested.

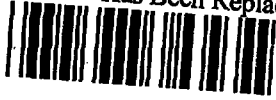
15 This solution is extremely complex because of the mechanisms to
16 move the probes (nails or needles) and the program to operate.

17 Furthermore this solution does not allow a complete universal
18 testing of all kinds of printed circuit cards because of the limitation
19 of the pattern of the test head.

20 EP,A,0 468 153 (ATG ELECTRONIC) 29 January 1992, discloses a
21 system in which the respective contact needles are not fixed in
22 position on the respective needle bearing board, but are movable
23 both axially and from their position along the coordinate axis.

24 In this way it is possible to make the testing machine universal.

25 Nevertheless, this solution is complex and requires a continuous
26 reprogramming. Furthermore this solution is lengthy because the
27 movable needles are obliged to move for a long way to reach the
28 exact coordinates, and this has to be done continuously during the



1 testing of each single card for the respective interested points to be
2 tested in the circuit.

3 EP-A-0 547 251 discloses a method for testing a micro circuit, where a
4 "wafer holder" and a "test head ... incorporating a matrix of probes"
5 is provided and wherein said wafer holder is movable on its (X-Y)
6 plane whereas the test head is movable along the orthogonal (Z)
7 direction.

8 This solution is able to test printed circuit cards because it is
9 conceived for testing on one side only.

10 Disclosure of Invention

11 The purpose of the present invention is that to obviate the above-
12 mentioned drawbacks, and in particular to allow the making of a
13 universal machine able to control the printed circuits, that is
14 having a system of conductive detection needles that can be adapted
15 to any type of circuit .

16 This and other purposes as claimed are obtained by means of
17 a machine for the control of printed circuits, comprising a board
18 bearing a plurality of conductive needles connectable on their
19 reverse side to analysis means of electric parameters between one
20 and the other needle: wherein

21 - two needle bearing boards are used, one opposing the other and
22 between them is placed for the analysis the respective printed
23 circuit card to be controlled, said printed circuit card being
24 movably supported on its plane,
25 characterized in that:

26 - each needle bearing board supports a plurality of conductive
27 needles said needles being axially movable only in the respective
28 needle bearing board;

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1 - at least one of said needle bearing boards is movable on its plane,
2 in order that the positioning of the needle concerned to put in
3 contact with the point concerned of the printed circuit of the card to
4 be tested, is obtained.

5 In this way it is obtained the immediate advantage of
6 simplifying all the system by making universal the application of
7 the machine on different printed circuits without needing adapters.
8 In fact by this it is possible to activate a board needle in any leading
9 end circuit position and to activate an opposite needle of the opposite
10 board, which thanks to the movability of the same board will be able
11 to reach any definite circuit end point to be tested independently
12 from its position, place and shape.

13 In this way the universalization of the testing system for any card is
14 ensured.

15 Advantageously the machine has also the characteristic that
16 the detection needles are axially movable.

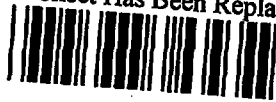
17 In this way, among a plurality of needles it is possible to make
18 interact only some of them, centring more easily the desired
19 positions of the printed circuit.

20 Further advantage derives from that with the axial movability of the
21 needles it is possible to contact better the respective desired points
22 of the circuit even when the card or the layer of the circuit is not
23 perfectly on the same plane in all its points.

24 Advantageously the needles are made axially movable by
25 electromagnetic means.

26 In this way the desired needle is operated in a simple and safe way.

27 These and other advantages will be shown by the following
28 description of embodiment preferred solutions with the help of the



1 included drawings whose details are not to be considered limitative
2 but only given as an example.
3 Figure 1 is a perspective schematic view of a detection board (bed);
4 Figure 2 is a cross-sectional schematic view of an axially movable
5 detection needle.
6 Figure 3 is a cross-sectional view of the preferred embodiment with
7 two opposite detection boards movable one respect to the other and
8 with the card to be controlled placed between them.
9 In particular in the figures the two detection testing boards are
10 indicated with 1 and 1'.
11 Each board has a plurality of needles axially movable 10 by
12 electromagnet 11.
13 Each needle is electrically connected to a known art electric
14 parameters control system 12.
15 The opposite boards as mentioned are movable one respect to the
16 other for the operative positioning.
17 The card positioned between these is indicated with 2.
18 The system provides a control by a net list "net-list" with relative
19 positions of single points.
20 The connection test is carried out from point to point, so that for
21 testing the connections of a net made of n points, are necessary n-1
22 tests between pairs of points selected in such a way to cover all the
23 connections.
24 The test on short circuits among different nets, is made by selecting
25 a point out of each pair of nets.
26 The maximum number for testing (testing) n nets in this way, is
27 calculated with the following formula:
28 $n*(n-1)/2$.

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1 This number can be reduced by selecting only alongside nets, that is
2 the ones close to each other in a pre-determined distance.
3 The positions to be tested are underdivided in sectors corresponding
4 to the number of needles in the movable board (bed), so that the
5 point to be tested is reachable with the position and with one of the
6 testing needles.
7 After the points to be tested are reached, it is necessary to check the
8 connection or insulation.
9 To shorten the time used for the movements, it is possible to optimize
10 the paths of the axes, by modifying the frequency of the single tests.
11 The machine is made up of a frame on which are fixed two opposite
12 boards and independently, movable respect to the two orthogonal
13 axes.
14 On the boards are fixed the testing sounds (needles) directly
15 operated by electromagnet in their axial movement.
16 At the beginning, the printed circuit is placed on a bearing frame
17 that transports it between the two boards.
18 In this position the card remains fixed.
19 The boards are put close to the card and the test begins.
20 Each board is independently controlled and operated, so that the
21 maximum stroke necessary is defined by the distance among the
22 sounds.
23 In correct position, the electromagnet operates the sound on the
24 surface to be contacted and thus by a pair of sounds simultaneously
25 operated is controlled the functionality of the circuit among the two
26 desired points, the respective continuity and eventual short circuits.
27 The process proceeds by points in repetitive way as desired.,
28 Advantageously also the card bearing may be moved respect to one

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1 or the other board.

2 In this way is obtained a wider universalization of use .

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Claims

- 1
- 2 1. Machine for the control of printed circuits, comprising a board
- 3 bearing (1) a plurality of conductive needles (10) connectable on
- 4 their reverse side to analysis means of electric parameters (12)
- 5 between one and the other needle: wherein
- 6 - two needle bearing boards (1,1') are used, one opposing the other
- 7 and between them is placed for the analysis the respective printed
- 8 circuit card to be controlled (2), said printed circuit card being
- 9 movably supported on its plane,
- 10 characterised in that:
- 11 - each needle bearing board supports a plurality of conductive
- 12 needles (19,11) said needles being axially movable only one in
- 13 respect to the other in the respective needle bearing board (1);
- 14 - at least one of said needle bearing boards (1,1') is movable on its
- 15 plane, in both its orthogonal axes, in order that the positioning of
- 16 the interested needle to put in contact with the interested point of
- 17 the printed circuit of the card to be tested (2), is obtained.
- 18 2. Machine according to claim 1, characterized in that both said
- 19 needle bearing boards (1,1') are movable in both their orthogonal
- 20 axes.
- 21 3. Machine according to previous claim, characterized in that the
- 22 movability of said needles is obtained by electromagnetic means
- 23 (11).
- 24 4. Machine according to any of the previous claims, characterized in
- 25 that it is made in such a way to operate in the testing between two
- 26 points of a circuit acting on one side with a needle of one board and
- 27 on the other side with a needle of the opposite board, after having
- 28 carried out a respective centring movement of the one respect to the



1 other and/or of both respect to the card circuit.

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☒ Drawing(s)	: paged	11 to	-
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2 **MACHINE FOR THE OPPOSITE CONTROL OF PRINTED CIRCUITS**

3 **Technical Field**

4 This invention has as object a machine for the opposite control of
5 printed circuits .

6 The invention finds particular even if not exclusive application in
7 the sector of the control of the printed circuit cards.

8 **Background Art**

9 In prior art machines for the control of the printed circuits are
10 known.

11 These machines generally consist of a board or bed bearing a
12 plurality of electrically conductive needles, on which must be
13 disposed the card with the printed circuit and by activating
14 properly the electric conductivity among the different needles and
15 by making the respective measurements it is possible to check whether
16 the printed circuit has defects.

17 Obviously for such control it is necessary for the needles to contact
18 the printed circuit in the proper position.

19 As the printed circuits are very different, it results necessary to
20 apply over the needle base board, an adaptation board that
21 comprises the same needles but displaced in a different way in
22 conformity with the printed circuit to be controlled.

23 The drawback of this solution is the limitation of the machine and
24 the possibility to control only the printed circuits that have at
25 disposal corresponding adapters or adaptation boards.

26 Needing as many adaptation boards as are the cards with different
27 printed circuits to be controlled.

28 Furthermore it is known that the layers of the circuits are not

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Date:

1 always coplanar, wherefore a suitable electric conduction for an
2 effective contact is not always ensured.

3 EP,A,0 164 722 (Black) 18 December 1985 discloses: an
4 automatic test system for testing printed circuit boards (cards) in
5 which:

6 In this document prior art is cited:

7 - use of a "bed of nails" (bed or plate or board of needles), in which
8 each nail or needle is fixedly placed in said bed or plate or board.

9 In this solution the "bed of nails" has the nail position absolutely
10 fixed and corresponding to the specific pattern of the printed card
11 to be tested.

12 Drawback of this solution is the requirement of as many "beds of
13 nails" as the different printed circuit cards to be tested.

14 - use of a universal grid matrix having a maximum possibility of
15 positionally fixed needles (nails) and a computer program to activate
16 only the required needles (nails) at a time. The programming being
17 dependant on the pattern of the printed card to be tested.

18 This solution has the drawback of continuously reprogramming the
19 machine. Furthermore, because the contact nails or needles are
20 bulky, it is impossible to cover all kinds of patterns.

21 This problem is avoided rendering displaceable along the coordinate
22 axis said contact needles or nails.

23 Nevertheless this solution requires a very complicated and
24 expensive construction of the testing machine and in this case the
25 needles or nails cannot be placed closely one next to the other.
26 Furthermore a continuous reprogramming is required to move one
27 needle or nail in respect to the other.

28 Finally, EP,A,0 164 722 discloses its claimed solution, in which there

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1 is a magazine for temporarily storing a plurality of probes (nails or
2 needles) and a base receiver member positioned adjacent to the test
3 head (bed or plate) on one side thereof and in a position to contact
4 the base of each probe. The test head (bed or plate) is adapted to
5 receive the probes and position the probes in a pattern matching
6 test points on the printed circuit board. Means are provided for
7 supporting the test head adjacent to the magazine and in a position
8 to receive probes (nails or needles) from the magazine. Means are
9 also provided for transferring selected ones of the probes from the
10 magazine to the test head.

11 The probes (nails or needles) are for this purpose, movable axially
12 from inside the said test head to the outside or vice versa and some
13 of these further axially moved in order to allow contact with the
14 printed circuit of the card to be tested.

15 This solution is extremely complex because of the mechanisms to
16 move the probes (nails or needles) and the program to operate.

17 Furthermore this solution does not allow a complete universal
18 testing of all kinds of printed circuit cards because of the limitation
19 of the pattern of the test head.

20 EP,A,0 468 153 (ATG ELECTRONIC) 29 January 1992, discloses a
21 system in which the respective contact needles are not fixed in
22 position on the respective needle bearing board, but are movable
23 both axially and from their position along the coordinate axis.

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1 testing of each single card for the respective interested points to be
2 tested in the circuit.

3 EP-A-0 547 251 discloses a method for testing a micro circuit, where a
4 "wafer holder" and a "test head ... incorporating a matrix of probes"
5 is provided and wherein said wafer holder is movable on its (X-Y)
6 plane whereas the test head is movable along the orthogonal (Z)
7 direction.

8 This solution is able to test printed circuit cards because it is
9 conceived for testing on one side only.

10 Disclosure of Invention

11 The purpose of the present invention is that to obviate the above-
12 mentioned drawbacks, and in particular to allow the making of a
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17 a machine for the control of printed circuits, comprising a board
18 bearing a plurality of conductive needles connectable on their
19 reverse side to analysis means of electric parameters between one
20 and the other needle: wherein

21 - two needle bearing boards are used, one opposing the other and
22 between them is placed for the analysis the respective printed
23 circuit card to be controlled, said printed circuit card being
24 movably supported on its plane,
25 characterized in that:

26 - each needle bearing board supports a plurality of conductive
27 needles said needles being axially movable only in the respective
28 needle bearing board;

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1 - at least one of said needle bearing boards is movable on its plane,
2 in order that the positioning of the needle concerned to put in
3 contact with the point concerned of the printed circuit of the card to
4 be tested, is obtained.

5 In this way it is obtained the immediate advantage of
6 simplifying all the system by making universal the application of
7 the machine on different printed circuits without needing adapters.
8 In fact by this it is possible to activate a board needle in any leading
9 end circuit position and to activate an opposite needle of the opposite
10 board, which thanks to the movability of the same board will be able
11 to reach any definite circuit end point to be tested independently
12 from its position, place and shape.

13 In this way the universalization of the testing system for any card is
14 ensured.

15 Advantageously the machine has also the characteristic that
16 the detection needles are axially movable.

17 In this way, among a plurality of needles it is possible to make
18 interact only some of them, centring more easily the desired
19 positions of the printed circuit.

20 Further advantage derives from that with the axial movability of the
21 needles it is possible to contact better the respective desired points
22 of the circuit even when the card or the layer of the circuit is not
23 perfectly on the same plane in all its points.

24 Advantageously the needles are made axially movable by
25 electromagnetic means.

26 In this way the desired needle is operated in a simple and safe way.

27 These and other advantages will be shown by the following
28 description of embodiment preferred solutions with the help of the

1 included drawings whose details are not to be considered limitative
2 but only given as an example.

3 Figure 1 is a perspective schematic view of a detection board (bed);

4 Figure 2 is a cross-sectional schematic view of an axially movable
5 detection needle.

6 Figure 3 is a cross-sectional view of the preferred embodiment with
7 two opposite detection boards movable one respect to the other and
8 with the card to be controlled placed between them.

9 In particular in the figures the two detection testing boards are
10 indicated with 1 and 1'.

11 Each board has a plurality of needles axially movable 10 by
12 electromagnet 11.

13 Each needle is electrically connected to a known art electric
14 parameters control system 12.

15 The opposite boards as mentioned are movable one respect to the
16 other for the operative positioning.

17 The card positioned between these is indicated with 2.

18 The system provides a control by a net list "net-list" with relative
19 positions of single points.

20 The connection test is carried out from point to point, so that for
21 testing the connections of a net made of n points, are necessary n-1
22 tests between pairs of points selected in such a way to cover all the
23 connections.

24 The test on short circuits among different nets, is made by selecting
25 a point out of each pair of nets.

26 The maximum number for testing (testing) n nets in this way, is
27 calculated with the following formula:

28 $n*(n-1)/2$.

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1 This number can be reduced by selecting only alongside nets, that is
2 the ones close to each other in a pre-determined distance.
3 The positions to be tested are subdivided in sectors corresponding to
4 the number of needles in the movable board (bed), so that the point
5 to be tested is reachable with the position and with one of the testing
6 needles.
7 After the points to be tested are reached, it is necessary to check the
8 connection or insulation.
9 To shorten the time used for the movements, it is possible to optimize
10 the paths of the axes, by modifying the frequency of the single tests.
11 The machine is made up of a frame on which are fixed two opposite
12 boards and independently, movable respect to the two orthogonal
13 axes.
14 On the boards are fixed the testing sounds (needles) directly
15 operated by electromagnet in their axial movement.
16 At the beginning, the printed circuit is placed on a bearing frame
17 that transports it between the two boards.
18 In this position the card remains fixed.
19 The boards are put close to the card and the test begins.
20 Each board is independently controlled and operated, so that the
21 maximum stroke necessary is defined by the distance among the
22 sounds.
23 In correct position, the electromagnet operates the sound on the
24 surface to be contacted and thus by a pair of sounds simultaneously
25 operated is controlled the functionality of the circuit among the two
26 desired points, the respective continuity and eventual short circuits.
27 The process proceeds by points in repetitive way as desired.
28 Advantageously also the card bearing may be moved respect to one

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- 1 or the other board.
- 2 In this way is obtained a wider universalization of use.

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Claims

1

2 1. A method for the control of printed circuits, using a machine
3 comprising a needle bearing board (1) bearing a plurality of
4 conductive needles (10) connectable on their reverse side to
5 analysis means of electric parameters (12) between one and the
6 other needle: wherein

7 - two needle bearing boards (1,1') are used, one opposing the other
8 and between them is placed for the analysis the respective printed
9 circuit card to be controlled (2), said printed circuit card being
10 movably supported ,

11 characterised in that:

12 - each needle bearing board supports a plurality of conductive
13 needles (10,11) said needles (10) being axially movable in the
14 respective needle bearing board (1) in order that amongst a
15 plurality of needles, it is possible to make only some of them
16 interact, to reach the desired positions of the printed circuit, even
17 when the card or the layer of the circuit is not perfectly on the
18 same plane in all its points;

19 - at least one of said needle bearing boards (1,1') is movable on its
20 plane, in both its orthogonal axes, in order that the positioning of
21 the interested needle to put in contact with the interested point of
22 the printed circuit of the card to be tested (2), is obtained

23 and wherein both said needle bearing boards (1,1') are movable in
24 both their orthogonal axes,

25 said movability of said needles (10) is obtained by electromagnetic
26 means (11),

27 and wherein the control of said printed circuits is made as follows:

28 - two needle bearing boards (1,1'), one opposite to the other are used

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1 and between them there is placed for the analysis, the respective
2 printed circuit card to be controlled (2),
3 the testing is operated between two points of a circuit acting on one
4 side with a needle of one board and on the other side with a needle of
5 the opposite board, after having carried out a respective centring
6 movement of the one respect to the other and/or of both respect to
7 the card circuit.

8 2. A method as claimed in claim 1, characterized in that:

9 - a control by a net list with relative positions of single points is
10 used.

11 3. A method as claimed in claim 1, characterized in that the test on
12 the printed circuit card, is carried out from point to point, so that for
13 testing the connections of a net of said printed circuit card, made of
14 n points, n-1 tests between pairs of points, are used.

15 4. A method as claimed in claim 1, characterized in that the test on
16 short circuits among different nets, is made by selecting a point out
17 of each pair of nets.

18 5. A method as claimed in claim 1, characterized in that the
19 maximum number for testing a certain number "n" of nets, is
20 calculated with the following formula:

21 $n*(n-1)/2$; the number being reducible selecting only
22 nets alongside, that is the ones close to each other in a pre-
23 determined distance.

24 6. A method as claimed in claim 1, characterized in that the positions
25 to be tested are subdivided in sectors corresponding to the number
26 of needles in the respective movable board (1,1'), so that the point to
27 be tested is reachable with the position and with one of the testing
28 needles, and after the points to be tested are reached, checking the

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1 connection or insulation is made.

2 7. A method as claimed in claim 1, characterized in that to shorten
3 the time used for the movements and to optimize the paths of the
4 axes, the frequency of the single tests is modified.

5 The machine is made up of a frame on which are fixed two opposite
6 boards and independently, movable in respect to the two orthogonal
7 axes.

8 8. A method as claimed in claim 1, characterized in that:

9 - at the beginning, the printed circuit is placed on a bearing frame
10 that transports it between the two boards;

11 - In this position the card remains fixed.

12 - The boards are put close to the card and the test begins.

13 - Each board is independently controlled and operated, so that the
14 maximum stroke necessary is defined by the distance among the
15 couple of needles (10).

16 - In correct position, the electromagnet (11) operates the needles to
17 exit to reach the surface to be contacted of the printed circuit, and
18 thus by a pair of needles simultaneously operated, is controlled the
19 functionality of the circuit among the two desired points, the
20 respective continuity and eventual short circuits.

21 - The process proceeds by points in a repetitive way as desired.

22 9. A machine for the control of printed circuits, comprising a needle
23 bearing board (1) bearing a plurality of conductive needles (10)
24 connectable on their reverse side to analysis means of electric
25 parameters (12) between one and the other needle: wherein

26 - two needle bearing boards (1,1') are used, one opposite to the other
27 and between them is placed for the analysis the respective printed
28 circuit card to be controlled (2).

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1 said printed circuit card being movably supported, using a method
2 according to previous claims,
3 characterised in that:
4 - each needle bearing board supports a plurality of conductive
5 needles (10,11) said needles (10) being axially movable in the
6 respective needle bearing board (1) in order that among a plurality
7 of needles, it is possible to make only some of them interact, to reach
8 the desired positions of the printed circuit, even when the card or
9 the layer of the circuit is not perfectly on the same plane in all its
10 points;
11 - at least one of said needle bearing boards (1,1') is movable on its
12 plane, in both its orthogonal axes, in order that the positioning of
13 the needle concerned to put in contact with the point concerned of
14 the printed circuit of the card to be tested (2), is obtained,
15 and wherein a computer system is used to make controls using a
16 couple of opposed needles (10-11) at a time, one on the upper needle
17 bearing board (1') and one on the lower needle bearing board (1)
18

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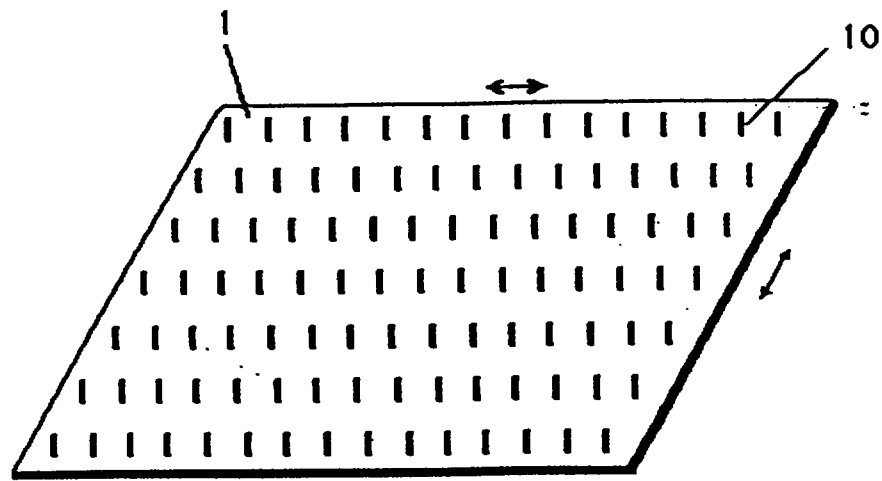


FIG. 1

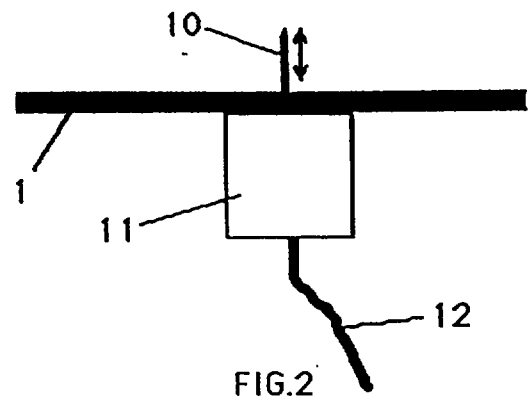


FIG. 2

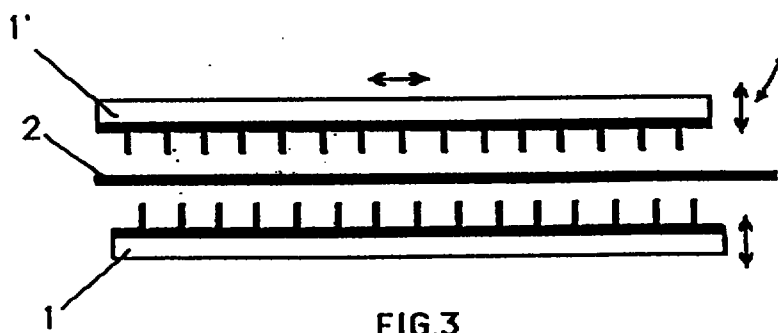


FIG. 3