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(54) **Title:** METHOD AND APPARATUS FOR TESTING ELECTRONIC BOARD JOINTS

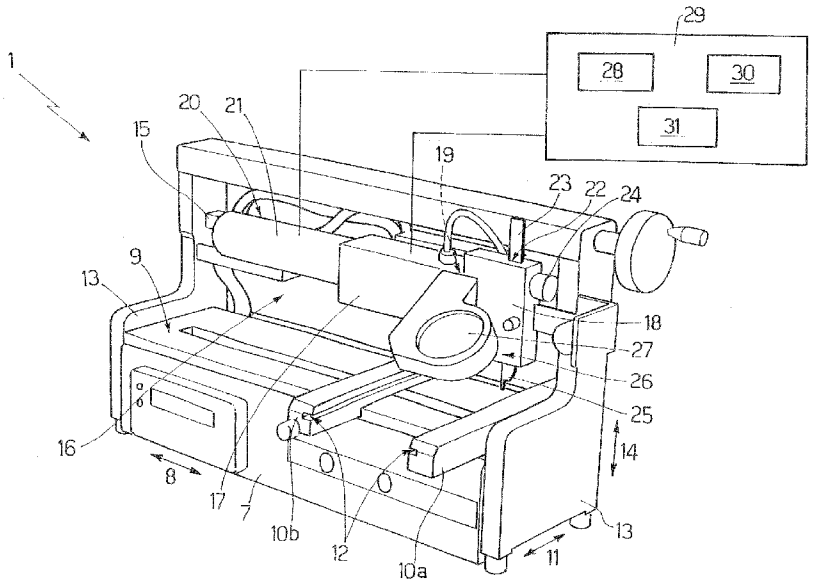

Fig.1

(57) **Abstract:** Method and apparatus for testing electronic board (2) joints (6), wherein joints (6) of at least a kind of component (5) of a given number (N) of a sample electronic board (2) are stressed up to failure so as to measure the corresponding breaking load, compute a corresponding threshold value, and allow to test the mechanical resistance of joints (6) of the same kind of component (5) of a plurality of further electronic boards (2) stressing the joints (6) themselves with a proof load equal, at a maximum, to the threshold value.

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METHOD AND APPARATUS FOR TESTING ELECTRONIC BOARD JOINTS

TECHNICAL FIELD

The present invention relates to a method for testing electronic board joints.

BACKGROUND ART

In the field of electronic board production, electronic boards having a plurality of electronic components soldered on printed circuits are known.

In general, the test of joint mechanical resistance is performed by sending a sample of the electronic boards produced to external specialized laboratories having special apparatuses able to stress up to failure the joints of each component of the electronic board and to determine the corresponding breaking load.

From above it follows that the test performed in specialized laboratories allows to test only the electronic boards of the sample sent to the specialised laboratories themselves, and does not allow to implement a test within the production process.

Moreover, as the apparatuses at present used in specialized laboratories are relatively complex and expensive, their cost can only be amortized by specialized laboratories, which use them to perform different kinds of test on different materials and products, whereas their cost is too high for electronic board manufacturers.

DISCLOSURE OF INVENTION

Aim of the present invention is to provide a method for testing electronic board joints that is free from the drawbacks described above and, at the same time, simple and easy to use.

According to the present invention there is provided a method for the test of electronic board joints according to claims 1 to 6.

Moreover, the present invention relates to an apparatus for testing electronic board joints.

According to the present invention there is provided an apparatus for testing electronic board joints according to claims 7 to 17.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the annexed figures, which illustrate a non-limiting example of embodiment thereof and in which:

- Figure 1 illustrates a schematic perspective view of a preferred embodiment of the apparatus for testing electronic boards joints according to the present invention;
- Figure 2 is a schematic perspective view of an electronic board;
- Figure 3 schematically illustrates the operating principle of the apparatus of Figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Figures 1-3, designated, as a whole, by 1 is an apparatus for testing the mechanical resistance of electronic board 2 joints. Each electronic board 2 comprises a substantially flat printed circuit 3 having a plurality of support surfaces 4 for different kinds of components 5, each of which is fixed on the printed circuit 3 at corresponding surfaces 4 through corresponding joints 6.

Apparatus 1 comprises an elongated base 7, which extends in an horizontal direction 8, at the top is limited by a an flat face 9, and is provided with a couple of parallel rails 10, which extend parallel to a horizontal direction 11 perpendicular to direction 8 and are one (in the following designated by 10a) fixed on the face 9 and the other (in the following designated with 10b) slidingly coupled to face 9, to perform, as regards base 7, rectilinear movements in direction 8 from and to rail 10a according to the dimension of printed circuits 3 of electronic boards 2.

Each rail 10a, 10b shows a longitudinal groove 12, which extends parallel to direction 11, is obtained along a rim of the corresponding rail 10a, 10b facing the other rail 10a, 10b, and slidingly accommodates, together with the other groove 12, the printed circuit 3 of an electronic board 2.

Moreover, apparatus 1 comprises two lateral posts 13, which are at the opposite sides of

base 7 in direction 8, extend in a vertical direction 14 orthogonal to directions 8 and 11, and support a connected horizontal crossbar 15 extending above base 7 in direction 8.

Crossbar 15 supports a pushing device 16 comprising a first slide 17, which is slidingly coupled to crossbar 15 to be moved, manually or under the push of a known and not illustrated actuating device, along crossbar 15 in direction 8, and supports in turn a second slide 18 slidingly coupled to slide 17 through the interposition of a load cell 19 to make, with respect to slide 17 and under the push of an actuating device 20, rectilinear movements in direction 8 itself.

Device 20 comprises an electric motor 21, which is fixed to slide 17 in parallel to direction 8, and is provided with a (non illustrated) output shaft coupled to slide 18 through a (non illustrated) nut-screw coupling.

Slide 18 is provided with a hole 22, which is bored through slide 18 parallel to direction 14, and slidingly accommodates a push member 23, which is blocked along hole 22 through a securing screw so as to protrude from the bottom of slide 18 itself. To this end, it is proper to mention that apparatus 1 is provided with a plurality of interchangeable push members 23, each of which is associated with a corresponding kind of component 5, and is provided with a lower end 25 suited so as to engage, during use, only the corresponding component 5 and not the corresponding joints 6.

The operation of apparatus 1 will be now described, assuming to test the mechanical resistance of joints 6 of a given kind of component 5, moreover assuming to have a given number N of sample electronic boards 2, and starting from a moment when on slide 18 push member 23 was mounted, corresponding to component 5 now under consideration.

Each sample electronic board 2 is mounted between rails 10a, 10b with the joints 6 of component 5 under consideration parallel to direction 8, while lower end 25 of member 23 is properly positioned in contact with component 5 under consideration, combining the shifts of slide 17 in direction 8 with the shifts of sample electronic board 2 in direction 11, and with the help of an optical magnifying device 26, defined, in this embodiment, by

a lens 27 linked to slide 17 itself.

Obviously, according to a non illustrated embodiment, lens 27 can be removed and e.g. a camera can replace it.

At this moment, slide 18 is moved in direction 8 through electric motor 21 so as to break joints 6 of component 5 with a load F parallel to joints 6 itself.

The above described operation is repeated on the component 5 under consideration in all N sample electronic boards 2 so as to allow load cell 19 to measure corresponding N values of breaking load and to a memory 28 of an electronic unit 29 (e.g. a computer) to memorize them.

Moreover, electronic unit 29 comprises a computation device 30 to compute a threshold value according to breaking load measured by load cell 19, and a regulating device 31 to allow pushing device 16 to selectively stress joints 6 of component 5 under consideration of electronic boards 2 as they are produced, using a proof load lower or, at a maximum, equal to threshold value as computed by device 30.

Obviously, all or only some of electronic boards 2 can be tested as they are produced, and the operation above described for a certain kind of component 5 can be repeated for other kinds of components 5 mounted on electronic boards 2.

Apparatus 1 shows some advantages, mainly following from:

1. apparatus 1 is relatively small and inexpensive, and can therefore be used directly by electronic board 2 manufacturers themselves;
2. when a component 5 does not pass the test and breaks off from printed circuit 3 under the push of corresponding proof load, it can be replaced with a new component 5 it, thus avoiding the elimination of the whole electronic board 2; and
3. when a component 5 breaks off from corresponding printed circuit 3, apparatus 1 allows to verify whether component 5 has broken off at corresponding joints 6 or corresponding support surfaces 4, meaning in the first case that joints 6 were not

properly performed, whereas in the second case joints 6 were properly made while support surfaces 4 of printed circuits 3 were not properly produced.

CLAIMS

1. Method for testing joints (6) of electronic boards (2), each electronic board (2) comprising a printed circuit (3) and a plurality of components (5) soldered on the printed circuit (3) itself; the method being characterized in comprising the following phases:
   - stressing up to failure joints (6) of at least one kind of component (5) of a given number (N) of sample electronic boards (2);
   - measuring a breaking load of joints (6) of the kind of component (5) of each sample electronic board (2);
   - computing a threshold value through said breaking loads; and
   - stressing the joints (6) of the same kind of component (5) of a plurality of further electronic boards (2) with a proof load at a maximum equal to said threshold value so as to verify the mechanical resistance of joints (6) themselves.

2. Method according to claim 1 and further comprising the following phases:
   - stressing up to failure joints (6) of each kind of component (5) of each sample electronic board (2);
   - measuring breaking loads of joints (6) of each kind of component (5) of each sample electronic board (2);
   - computing, for each kind of component (5) a corresponding threshold value through corresponding breaking loads; and
   - stressing the joints (6) of each kind of component (5) of a plurality of further electronic boards (2) with a proof load at a maximum equal to said threshold value so as to verify the mechanical resistance of joints themselves.

3. Method according to claim 1 or 2 and comprising further, for each kind of component (5) of sample electronic boards (2), the phase of

   - memorizing the corresponding breaking load and the corresponding threshold value.

4. Method according to any of the preceding claims, wherein each joint (6) extends in a determined direction (8); the method comprising further the phase of:

   - stressing joints (6) parallel to said direction (8).

5. Method according to any of the preceding claims, and further comprising the phase of:

   - maintaining during use each electronic board (2) in a horizontal position.

6. Method according to any of the preceding claims, and further comprising the phase of:

   - applying said breaking and proof load to components (5) only, and not to corresponding joints (6).

7. Apparatus for testing joints (6) of electronic boards (2), each electronic board (2) comprising a printed circuit (3) and a plurality of components (5) soldered on the printed circuit (3) itself; the apparatus being characterized in that it comprises a pushing device (16) to stress up to failure joints (6) of at least one kind of component (5) of a given number (N) of sample electronic boards (2); a device (19) for measuring the breaking load of joints (6) of said kind of component (5) of each sample electronic board (2); a computing device (30) to compute a threshold value through said breaking load; and a regulating device (31) to selectively test the pushing device (16) so as to stress the joints (6) of the same kind of component (5) of

a plurality of further electronic boards (2) with a proof load at a maximum equal to said threshold value and to verify the mechanical resistance of corresponding joints (6).

8. Apparatus according to claim 7 and further comprising a memory (28) to memorize, for each kind of component (5) of sample electronic boards (2) the corresponding breaking load and the corresponding threshold value.

9. Apparatus according to claim 7 or 8 and further comprising a support device (10a, 10b) to maintain, in use, electronic boards (2) in a horizontal position.

10. Apparatus according to claim 9, wherein support device (10a, 10b) comprises a rail (10a, 10b) able to slidingly accommodate said electronic boards (2).

11. Apparatus according to any of claims 7 to 10, wherein the pushing device (16) comprises at least a push member (23) pushing, in use, said components (5).

12. Apparatus according to claim 11, and further comprising a plurality of said push members (23) each of which is associated with a given kind of component (5).

13. Apparatus according to claim 11 or 12, wherein each push member (23) is suited so as to engage, during use, only corresponding component 5 and not corresponding joints 6.

14. Apparatus according to any of claims 11 to 13, wherein each joint (6) extends in a given direction (8); push member (23) being mobile, in use, in said direction (8).

15. Apparatus according to any of claims 11 to 14, wherein the pushing device (16) further comprises a support slide (18) mobile in a given direction (8); push organ (23) being removably mounted on the support slide (18) itself.

16. Apparatus according to any of claims 11 to 15 and further comprising an optical device (27) allowing a correct positioning of push organ (23) with respect to said components (5).

17. Apparatus according to any of claims from 9 to 16, wherein support device (10a, 10b) comprises a rail (10a, 10b) which extends in a first given direction (11), and can be slidingly engaged by said electronic boards (2); the pushing device (16) comprising at least a push member (23) able, in use, to engage said components (5) and to shift in a second direction (8) substantially perpendicular to said first direction (11) itself.

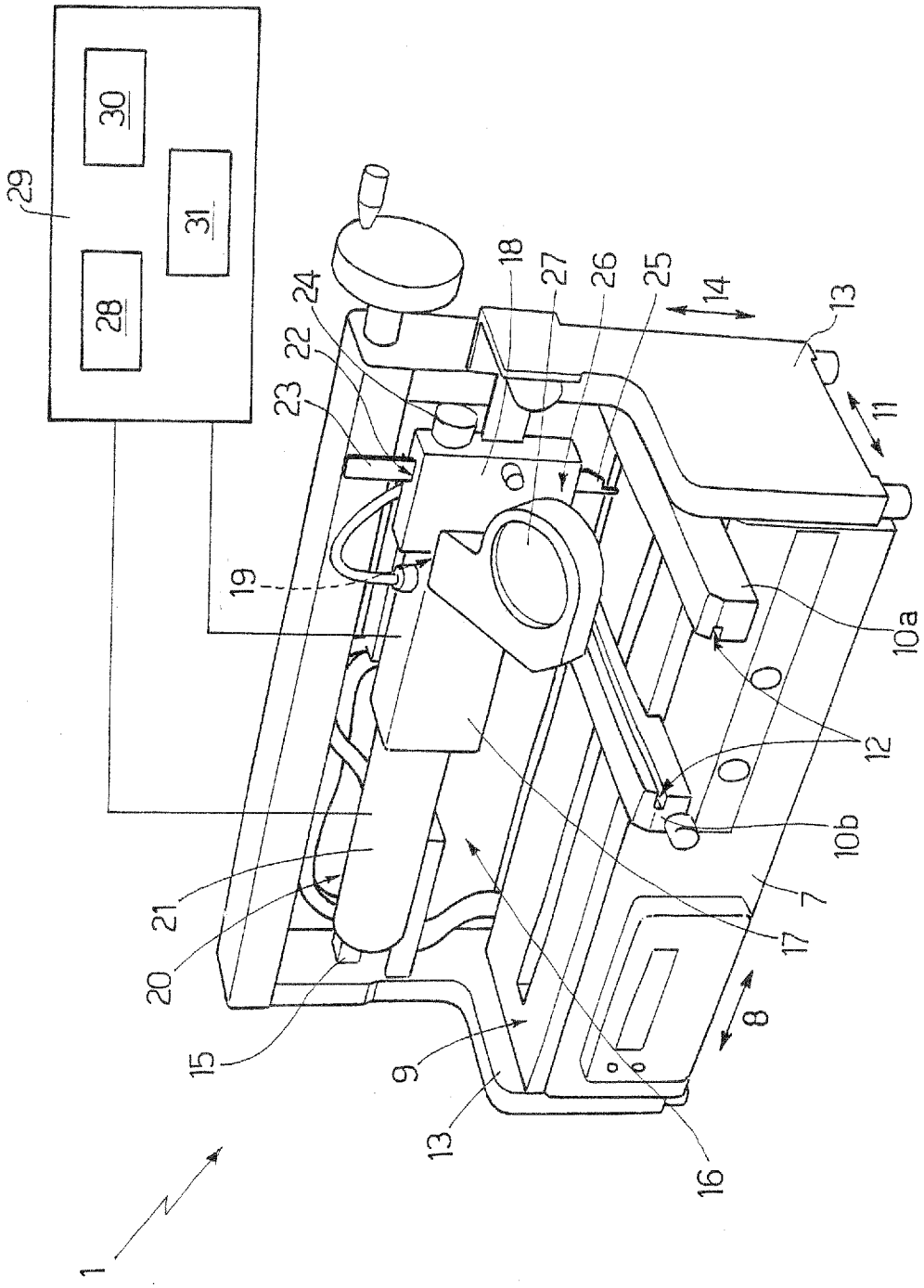
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Fig.1

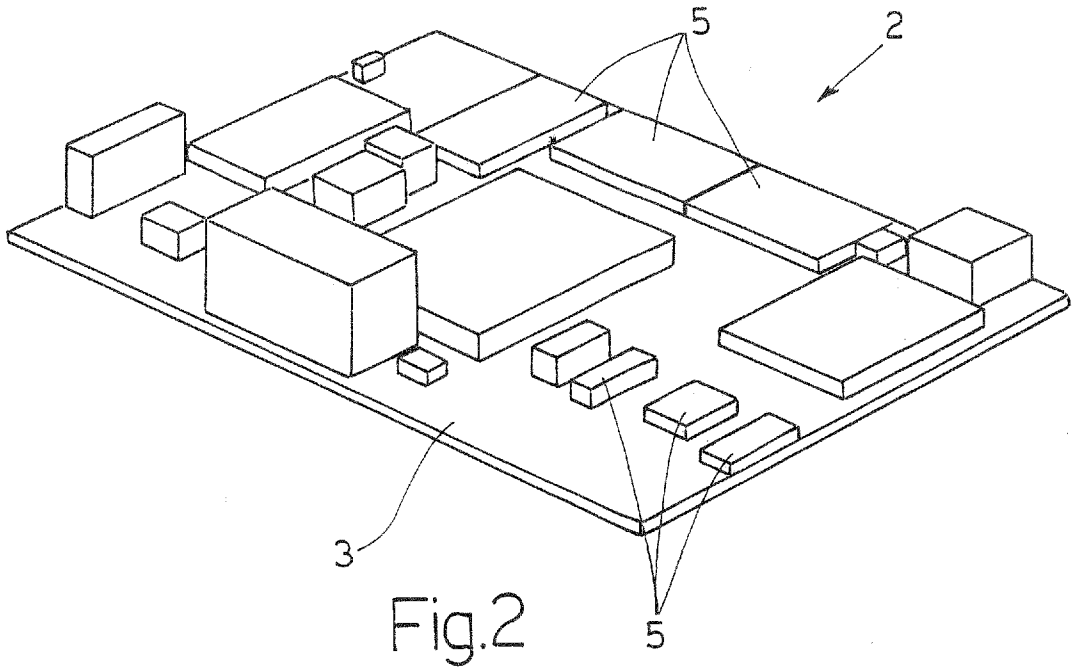

Fig.2

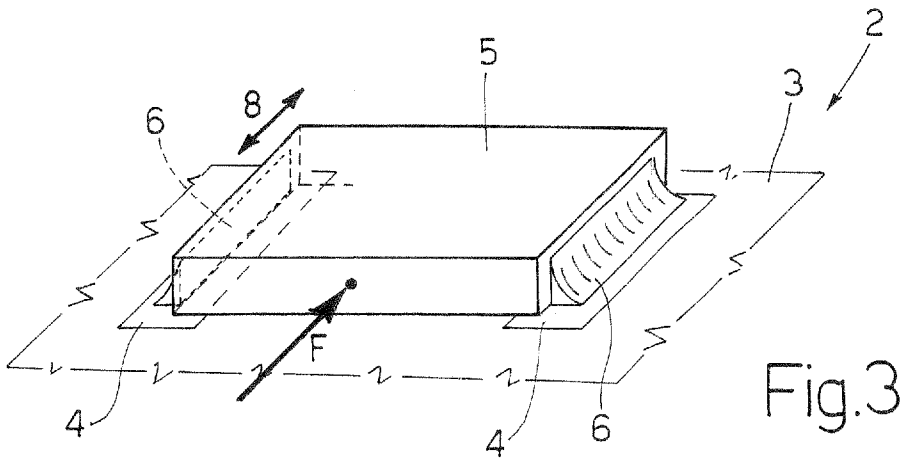

Fig.3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/052961

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01N19/04 G01N3/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 38 32 775 A1 (SIEMENS AG [DE]) 29 March 1990 (1990-03-29) the whole document	1-17
A	US 6 220 102 B1 (LIAO KUANG-HO [TW]) 24 April 2001 (2001-04-24) abstract; figures 1,2 column 4, line 7 - line 24	1-17
A	US 2002/121149 A1 (LEE LAN-SONG [TW] ET AL) 5 September 2002 (2002-09-05) abstract; figure 2	1-17
A	US 5 591 920 A (PRICE SUSANNE F [US] ET AL) 7 January 1997 (1997-01-07) column 2, line 24 - line 39	1-17

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
5 June 2008	13/06/2008

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/052961

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	"SHEAR FORCE TESTERS ON CHIPS GLUED ON PCB" IBM TECHNICAL DISCLOSURE BULLETIN, IBM CORP. NEW YORK, US, vol. 32, no. 10A, 1 March 1990 (1990-03-01), pages 315-317, XP000083332 ISSN: 0018-8689 page 317, line 23; figure 3	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2008/052961

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