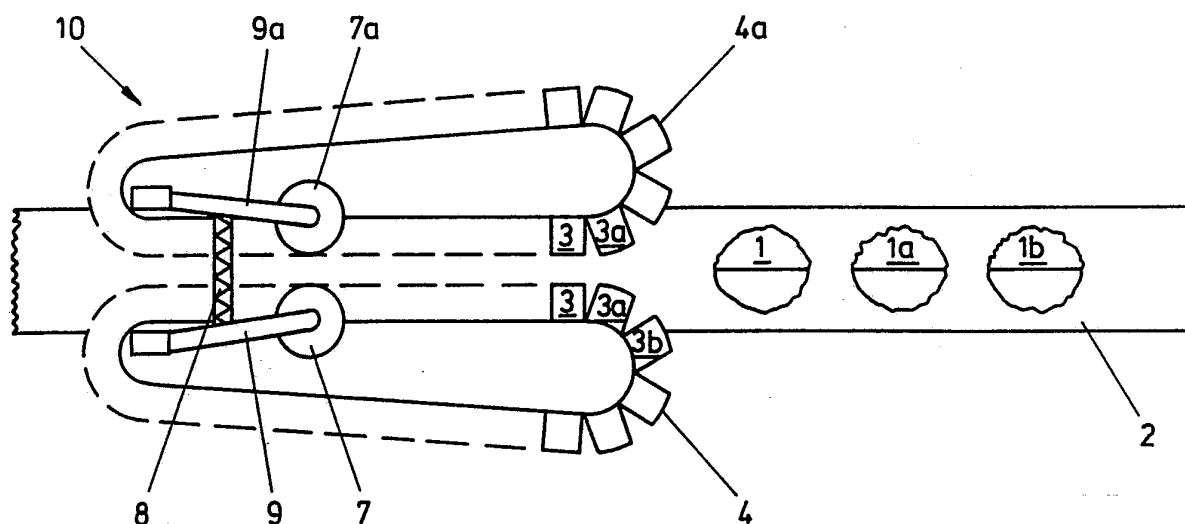




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(54) Title: INTEGRITY TESTING DEVICE FOR SEALED FLEXIBLE PACKAGES**(57) Abstract**

There is disclosed a testing device (10) for testing the integrity of a sealed closure (11, 12) of a flexible package (1) which is at least partly inflated with product and a surrounding gas, in which the device comprises: a squeezing device in the form of two endless tracks (4, 4a) of resiliently deformable fingers (3) which engage on opposite sides of a lower part (5) of the outer periphery of each part inflated package (1) fed thereto by a conveyor (2) and which squeeze a portion of the gas in the package to an upper monitoring zone (6) of the package which becomes inflated, or further inflated; a monitoring device (7, 7a) arranged downstream of the squeezing device to monitor the inflated zone (6) of each package; and a detector means (8) associated with the monitoring device (7, 7a) and operative to detect by mechanical or other means any possible leakage of gas from the package while it is passing through the testing device (10).

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INTEGRITY TESTING DEVICE FOR SEALED FLEXIBLE PACKAGES

This invention relates to a testing device for testing the sealing integrity of a closed flexible package containing a product and a surrounding gas.

Flexible packages have many different uses in order to store products therein, with each particular product being introduced into an open package after manufacture and / or treatment of the product, and which is then followed by closure of the package in sealed manner with the product contained therein, and with a surrounding gas also contained within the package. The surrounding gas may be atmospheric air for some products, whereas for other products it may be necessary to specify that the surrounding gas introduced into the package is suitably inert with respect to the product and also the packaging material. By way of example only, peanuts are normally stored within nitrogen filled packages, whereas nuts and bolts can be contained within air filled packages, or with suitably inert gas which will prevent any corrosion of the nuts and bolts.

Flexible packages are used to package food products, such as potato crisps and sweets and the like, or products such as sets of screws, nuts and bolts, and the packages must be sufficiently durable to enable the packages to be transported and handled at least up to the time of sale, so that the customer can have the assurance that, in the case of a food product, no contamination or tampering of the product has taken place, and in the case of a non-edible product the assurance that the package has the required number of product contents with none of the products having been lost from the package in transit.

This assurance is normally provided for the customer by immediate visual inspection, in that flexible packages usually contain an appreciable volume of gas surrounding the product, so that the package is usually at least partly inflated. Evidently, any faulty sealing in the closure of the package will either result in a substantially flat or

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uninflated package, or else it will take-up this state when picked-up by a customer from a shelf or other display point.

Flexible packages are usually filled with product on a mass production basis, with open packages being conveyed through a filling / loading station to receive the product, followed by sealed closure of each package with gas therein, and discharge to a packing and dispatch station.

Various forms of testing equipment are known to check the integrity of sealed closures of flexible packages, and most of these try to measure the package thickness over the entire surface of the package, and make the (unwarranted) assumption that the package contents and the surrounding gas will have a greater dimension, measured in the thickness measuring direction, which will always be greater than the longest dimension of any individual element of the product e.g. a particular bolt in a package of nuts and bolts.

However, in the case of a package or packet of crisps, or bolts, it may well happen that the volume of gas may be located mainly in one part of the package whereas the product is in another part, and therefore the product may well occupy a position in which the measured width of the package at this position will be greater than at the rest of the package.

Some other checking devices use negative pressure to attempt to detect possible closure seal failures, but generally do not operate satisfactorily and to consistent standards.

Accordingly, most existing testing devices and techniques rely upon the assumption that the products within the packages will not prevent successful observation and measurement of the packages, which is an assumption which is not always borne out in practice.

Accordingly, the invention seeks to provide an improved design of testing device for testing the integrity of a sealed closure of a flexible package which is at least partly inflated with product and surrounding gas, and which is able to operate to improved standards of testing efficiency.

According to the invention there is provided a testing

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device for testing the integrity of a sealed closure of a flexible package which is at least partly inflated with product and a surrounding gas, said device comprising:

a squeezing device which is engageable with a part of the outer periphery of the part inflated package, and which is operable to squeeze and direct a portion of the gas in the package to a monitoring zone of the package which thereby is inflated, or further inflated, by this directed portion of gas;

a monitoring device arranged to monitor the inflated zone of the package; and,

a detector means associated with the monitoring device and operative to detect any possible leakage of gas from the package.

Thus, in use of the device, a flexible sealed package and its contents (product and gas) can be readily presented to the testing device so as to undergo action by the squeezing device, and the gas in the package is therefore directed to any suitable monitoring zone of the package which becomes enlarged in volume, and which can then be monitored by the monitoring device and the detector means is then able to detect any gas leakage.

The squeezing action of the squeezing device will be a suitably gentle action, having regard to the nature of the product in the package, and sufficient to cause movement of gas in the package to the monitoring zone.

Conveniently, the squeezing device is a two part device, at least one part of which is composed of resiliently deformable elements.

In a preferred arrangement, the or each part of the squeezing device comprises an endless arrangement of sponge-like fingers.

Since flexible packages are usually filled and sealed on a mass production basis, conveniently the packages are conveyed on a continuous basis to the squeezing device, and which applies the required squeezing action to the packages as they continue their onward conveying movement to the

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monitoring device which monitors the inflated monitoring zones of each package and via the detector means gives automatic indication of a faulty package.

A conveyor may be provided to convey the packages through a testing station at which the testing device is mounted, and the squeezing device may comprise two endless runs of squeezing elements which have working paths which run alongside the conveyor and which apply gentle squeezing action to each package as the packages are conveyed to the monitoring device. Conveniently, the squeezing action is applied to a lower portion of each package, and the monitoring zone may therefore comprise an upper portion of each package or bag, so that the monitoring device will be arranged along the path of the inflated upper portion of each package.

The monitoring device may comprise a pair of engaging or measuring heads engageable on opposite sides of the inflated upper portion of each package, and the detector means may comprise a measuring device responsive to movement of one, or both of the heads as a consequence of escape of gas from the package. However, it is not essential to the invention to provide a purely mechanical measurement of package deflation, and other types of detector means may be provided within the neighbourhood of the package in order to detect any escape of gas.

Accordingly, as will become apparent from the subsequent description of a preferred embodiment of the invention, the following advantages are achievable:

1. The testing device can be used with different shapes of package, and package contents;
2. The testing device is easily adaptable to a wide range of package size and shape and variation in packaging material, with minimal alteration;
3. The testing device is capable of operating on a continuous basis as part of a mass production system throughput; and,
4. The testing device is substantially non-intrusive,

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to minimise any risk of damage to the package contents.

A preferred embodiment of the invention will now be described in detail, by way of example only, with reference to the accompanying schematic drawings, in which:

Figure 1 is a side view of a testing device according to the invention mounted alongside a conveyor track of a mass-production package filling, closing and discharge installation;

Figure 2 is a plan view of the testing device shown in Figure 1;

Figure 3 is a schematic end view illustrating the manner by which a two part squeezing device of the testing device is engageable with a part of the outer periphery of a part inflated filled and sealed package; and,

Figure 4 is a similar view of a monitoring part of a testing device to which the packages are fed while being engaged by the squeezing device in order that the integrity of the sealed closure of each package can be tested.

Referring now to the drawings, a testing device according to the invention is designated generally by reference 10 and is intended to test the integrity of a sealed closure of a flexible package which is at least partly inflated with product and surrounding gas, and in the illustrated arrangement receives a succession of closed packages 1, 1a, 1b etc as shown in Figures 1 and 2, which are fed thereto by a continuous conveyor 2.

The testing device 10 has a two part squeezing device 4, 4a which is engageable with a part of the outer periphery of each part inflated package, as can be seen particularly in Figure 3, and which is operable to squeeze and direct a portion of the gas in the package to a monitoring zone of the package which thereby is inflated, or further inflated by this directed portion of gas. In the arrangement shown in Figure 3, the part of the outer periphery of the package which is squeezed is the lower portion 5, and the monitoring zone portion which receives the gas squeezed out from the lower portion 5 comprises an upper portion 6 of the package.

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Each part 4, 4a of the squeezing device comprises an endless arrangement of sponge-like fingers 3, 3a, 3b etc, which form an endless belt-like conveyor caused to travel at the same speed as the conveyor 2, and having working paths in which they run alongside the path of travel of the conveyor 2, as can be seen in Figure 2. The fingers are resiliently deformable, so as to apply a gentle squeezing action on the lower part 5 of each package, as shown in Figure 3, which displaces some of the gas within the sealed package towards the upper zone 6 of each package. It will be noted from Figure 3 that the fingers only apply a partial squeezing action on the package, which will generally be a non-intrusive squeezing action, such as not to cause any damage to any package contents which happen to be located in the lower part of the package during the squeezing action.

The testing device 10 also includes a monitoring device which is arranged downstream of the region of first engagement of the squeezing device 4, 4a, and to which the squeezed packages are fed, and which monitors the inflated zone 6 of each package. In the illustrated arrangement, the monitoring device comprises a pair of engaging heads 7, 7a, engageable with opposite sides of the zone 6, as can be seen in Figure 4, thereby to monitor the inflated zone of each package. For any particular package, contents and gas contained therein, the sealed packages fed to the testing device 10 will normally come within a predetermined range of shapes and sizes, and the setting-up of the heads 7 and 7a will be such as to monitor the inflated zones of packages coming within an acceptable range. The heads 7, 7a effectively comprise measuring heads, and are urged by any suitable biasing means inwardly to engagement with the opposed outer sides of the inflated zone 6, and a distance sensor 8 associated with pivoting arms 9, 9a which carry the heads 7 and 7a respectively functions to measure the separation between the heads 7 and 7a for each package to be monitored.

The heads 7 and 7a may comprise rollers which are

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arranged to apply a predetermined pressure and for a predetermined time to the upper monitoring zone 6 of each package, and any leakage from the closure seals of each package will be manifested, and detected by a reduction in the distance D between the heads 7, 7a, as measured by distance sensor 8.

The monitoring device component of the testing device 10 is therefore formed by the mechanical engagement of each inflated zone 6 between heads 7, 7a, and a detection means associated with the monitoring device (7, 7a) and which operates to detect any possible leakage of gas from the package comprises mechanical measurement of the spacing between the heads 7, 7a via distance sensor 8. However, it should be appreciated that many other types of detection means may be provided, associated with the monitoring device, and operative to detect any possible leakage of gas while the package is being squeezed. Non-mechanical detector means may be adopted, including "sniffer" devices, bubble and noise detectors, optical measurement devices, as well as other measuring devices such as distance measuring devices, and angle measuring devices.

Furthermore, while the illustrated embodiment of monitoring device comprises mechanically acting measuring heads 7, 7a, which make direct engagement with the inflated zone 6 of each package, other arrangements of monitoring device may be provided within the scope of the invention, and which include non-contact type arrangements, which may include acoustic, optical or electronic monitoring devices, arranged in any suitable arrays in order to respond to changes in distance across the upper monitoring zone 6, which thereby provides response to changes in pressure within the packages which would be indicative of a gas leakage under the squeezing action of the squeezing fingers 3 of the two part squeezing device.

The monitoring heads 7, 7a are shown only schematically in Figures 1 and 2, and in order to speed-up throughput through the testing device 10, the measuring heads provided

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by the monitoring device may be arranged to travel a short distance with each package being tested, before returning to carry out a monitoring cycle of operation with the next package.

Figures 3 and 4 show end views of a typical flexible package, which could be a package of the type used to contain snack foods, such as potato crisps, and in which the package contents (not shown) will be surrounded by gas of any suitable type which is compatible both with the contents and also the packaging material e.g. nitrogen gas in the case of potato crisps, and after filling with product and gas, each package will then take-up a partly inflated shape, and with sealed closures along initially open end(s) of each package. By way of example only, Figure 3 shows top and bottom end closure seals 11 and 12 respectively, and it is the purpose of the testing device 10 to test the integrity of the or each closure seal of each flexible package.

Depending upon the product to be stored within the package, it may be tolerable for the seal to be of such a nature that small gas leakage takes place under the pressure of the squeezing action by the testing device 10, since during subsequent storage and transport, and further handling, the packages may not be exposed to such strong squeezing action. For other products, and particularly food products, it will often be the case that the requirement will be for substantially leak-proof sealing of the packaging, in which case the monitoring system should be set-up to monitor, and reject any package which is subject to loss of gas during the squeezing and monitoring operations. Therefore, the parameters of the monitoring and detecting system will be set-up according to particular requirements, and for certain cases may tolerate a "slow" leakage of gas during the squeezing and monitoring operation, whereas in other cases substantially no gas leakage will be permitted. In the case of a total seal failure, the measuring heads 7, 7a will substantially abut each other, and no distance D will be measured, whereas smaller or larger degrees of leakage will

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be represented by variation in the distance measured D , and the system will then decide which can be tolerated, and which cannot.

CLAIMS

1. A testing device (10) for testing the integrity of a sealed closure (11, 12) of a flexible package (1) which is at least partly inflated with product and a surrounding gas, said device comprising:

a squeezing device (4, 4a) which is engageable with a part (5) of the outer periphery of the part inflated package (1), and which is operable to squeeze and direct a portion of the gas in the package to a monitoring zone (6) of the package which thereby is inflated, or further inflated by this directed portion of gas;

a monitoring device (7, 7a) arranged to monitor the inflated zone (6) of the package (1); and

a detector means (8) associated with the monitoring device (7, 7a) and operative to detect any possible leakage of gas from the package (1).

2. A testing device according to Claim 1, in which the squeezing device (4, 4a) is a two part device, at least one part of which is composed of resiliently deformable elements (3).

3. A testing device according to Claim 1 or 2, in which at least part of the squeezing device comprises an endless arrangement of resiliently deformable fingers (3).

4. A testing device according to any one of Claims 1 to 3, including a conveyor (2) arranged to feed sealed packages (1, 1a, 1b) on a continuous basis to the squeezing device (4, 4a).

5. A testing device according to Claim 4, in which the squeezing device has squeezing elements (3) which are engageable with opposed sides of each package (1) and which are movable with the conveyor (2) to feed the squeezed packages to the monitoring device (7, 7a).

6. A testing device according to Claim 5, in which the testing device (10) is mounted at a testing station through which the conveyor (2) is movable, the squeezing device comprising two endless runs (4, 4a) of squeezing elements (3)

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which have working paths which run alongside the conveyor (2) and which are operative to apply a gentle squeezing action to each package as the package is conveyed to the monitoring device (7, 7a).

7. A testing device according to Claim 6, in which the squeezing device is operative to apply a squeezing action to the lower portion (5) of each package (1), and the monitoring zone (6) comprises an upper portion of each package, and in which the monitoring device (7, 7a) is arranged along the path of movement of the inflated upper portion (6) of each package.

8. A testing device according to any one of Claims 1 to 7, in which the monitoring device comprises a pair of engaging heads (7, 7a) engageable on opposite sides of the inflated zone (6) of each package, and in which the detector means comprises a measuring device (8) responsive to movement of one, or both of the engaging heads (7, 7a) as a consequence of escape of gas from the package being monitored.

9. A testing device according to any one of Claims 1 to 7, in which the detector means comprises a gas sniffer device, a bubble detector device, a noise detector device, an optical detector system, a distance measuring device or an angle measuring device.

10. A testing device according to any one of Claims 1 to 7, in which the monitoring device is of the non-contact type, and comprises an acoustic, optical or electronic device for monitoring the inflated state of the monitoring zone (6) of each squeezed package (1).

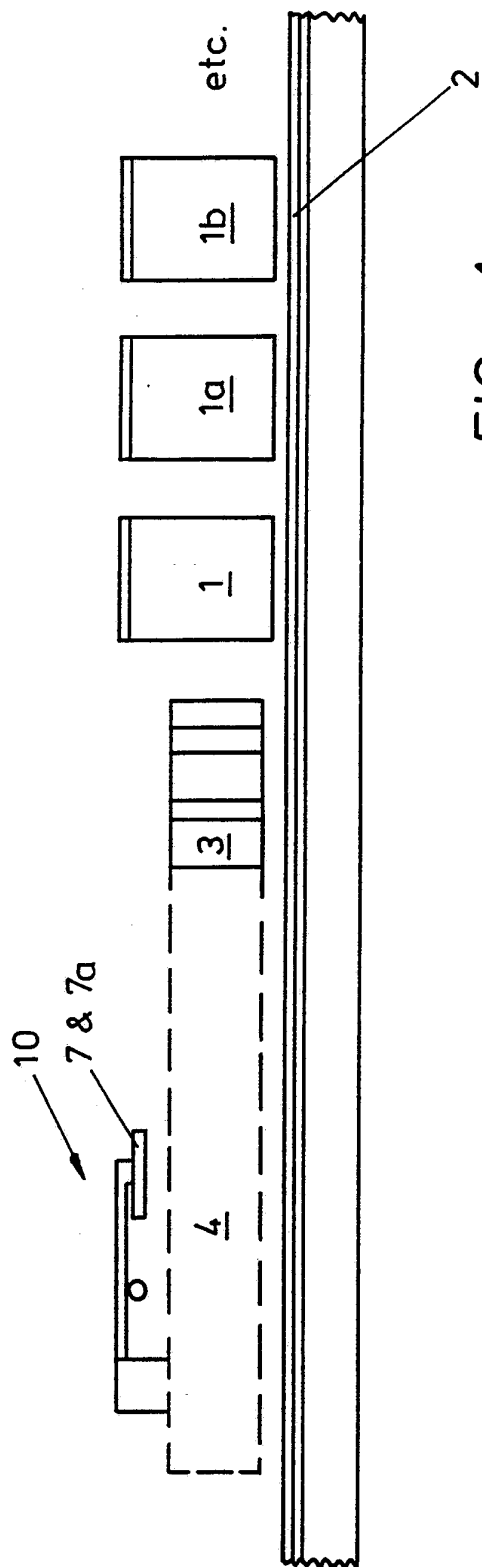


FIG. 1

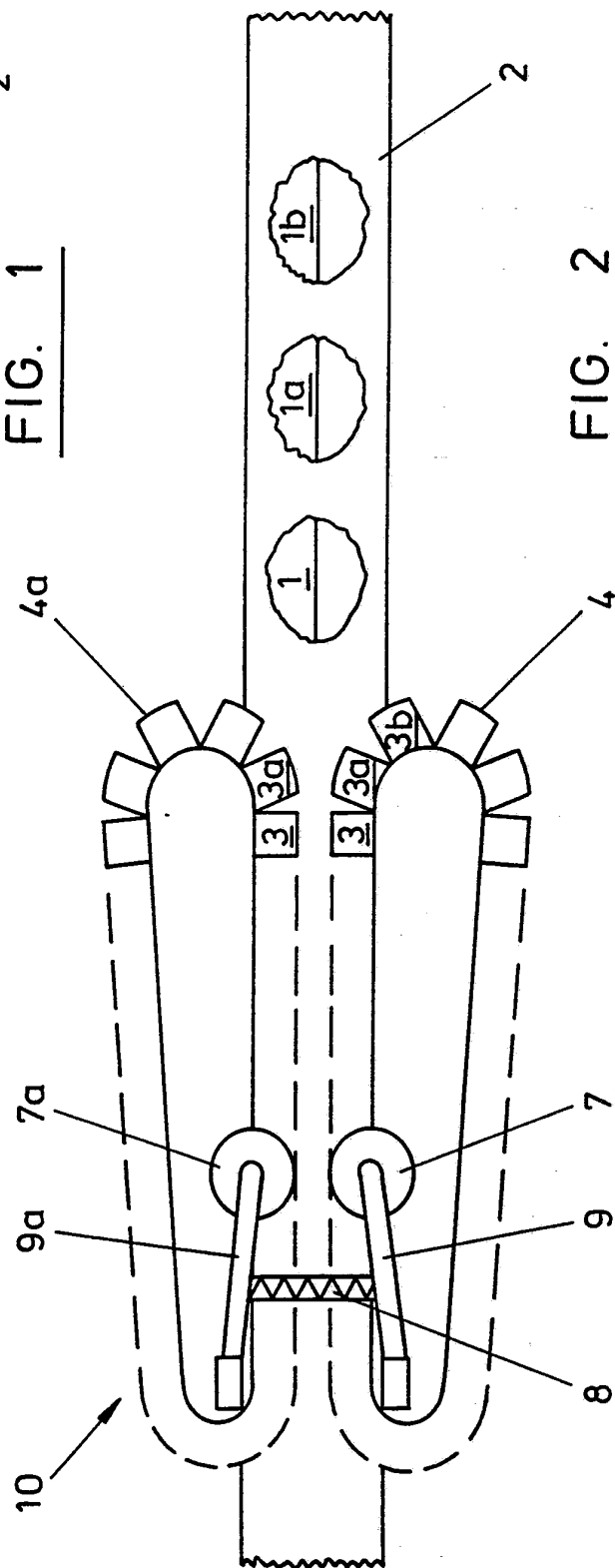
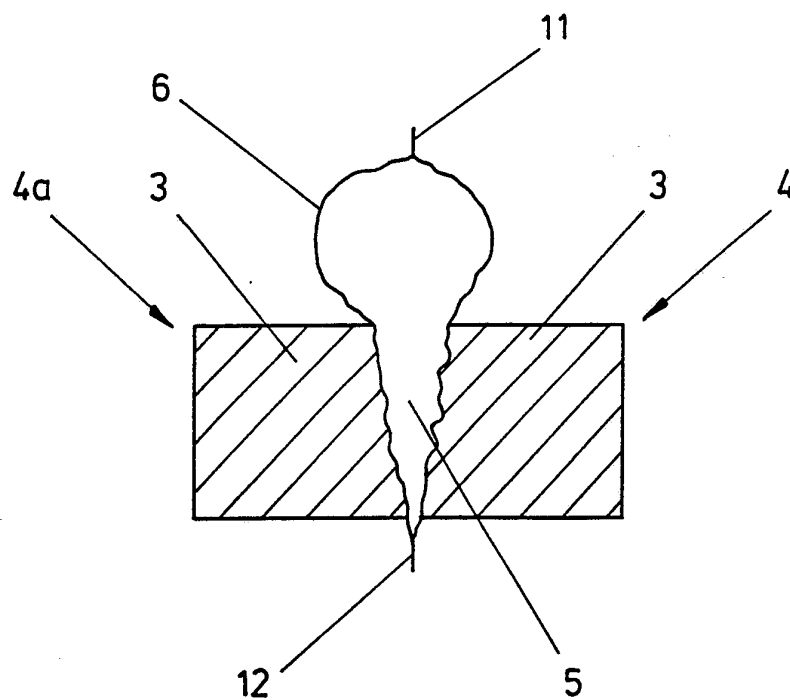
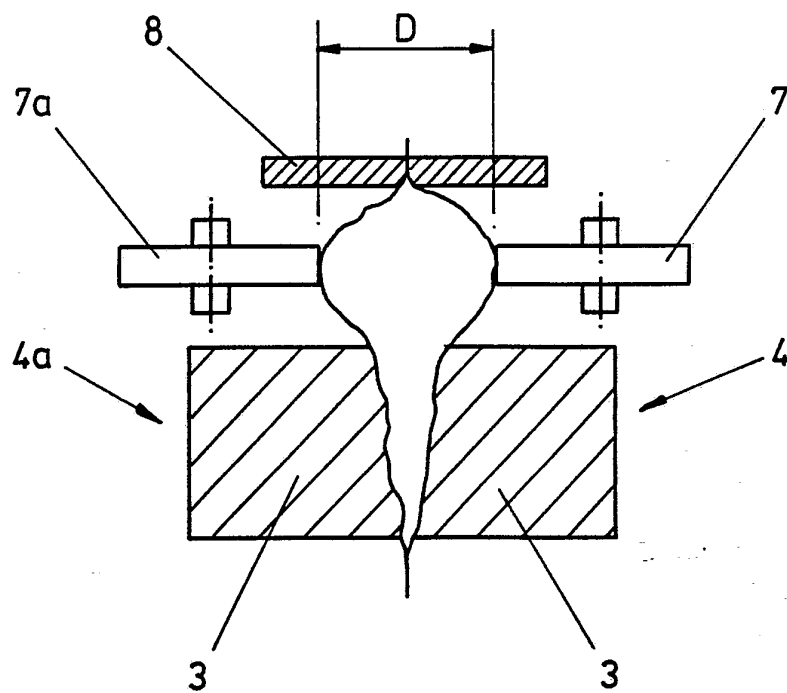


FIG. 2

-2/2-

FIG. 3FIG. 4

INTERNATIONAL SEARCH REPORT

PCT/GB 92/01818

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 G01M3/36		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	G01M	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US,A,4 955 226 (BEATY ET AL.) 11 September 1990 see column 3, line 29 - column 5, line 10; figures	1
A	GB,A,2 059 381 (DANEPAK LTD) 23 April 1981 see page 3, line 3 - line 74; figures 4-5	1
A	EP,A,0 082 605 (HULBRITT DEVELOPMENTS LTD) 29 June 1983 see page 9, line 4 - page 13, line 19; figures 1-4	1
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
27 JANUARY 1993	10.02.93	
International Searching Authority	Signature of Authorized Officer	
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9201818
SA 65901

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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27/01/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4955226	11-09-90	None	
GB-A-2059381	23-04-81	None	
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