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PROCESS FOR GENERATING SMOKE AEROSOLS AND PYROLYSIS DEVICE FOR CARRYING OUT SAID PROCESS
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- (57) Claim

1. A method of generating smoke aerosols for planning, testing or demonstration of fire alarm systems comprising pyrolysing a test material by heating the test material to release smoke aerosols, wherein the test material is heated for a specific period of time according to a specific, predetermined temperature curve, and wherein the specific period of time is fixed in accordance with the required minimum and maximum response times of an early warning fire alarm system.



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(21) Internationales Aktenzeichen: PCT/EP94/02917 (22) Internationales Anmeldedatum: 2. September 1994 (02.09.94) (30) Prioritätsdaten: P 43 29 847.8 3. September 1993 (03.09.93) DE (71) Anmelder (für alle Bestimmungsstaaten ausser US): WAGNER ALARM- UND SICHERUNGSSYSTEME GMBH [DE/DE]; Am Pferdemarkt 9, D-30853 Langenhagen (DE). (72) Erfinder; und (75) Erfinder/Anmelder (nur für US): WAGNER, Ernst-Werner [DE/DE]; Posenerstrasse 1, D-29308 Winsen/Aller (DE). (74) Anwalt: LIECK, H.-P.; I. Endlich & Partner, Widenmay- erstrasse 36, D-80538 München (DE).		(81) Bestimmungsstaaten: AU, CA, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Veröffentlicht <i>Mit internationalem Recherchenbericht. Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist. Veröffentlichung wird wiederholt falls Änderungen eintreffen.</i>
(54) Title: PROCESS FOR GENERATING SMOKE AEROSOLS AND PYROLYSIS DEVICE FOR CARRYING OUT SAID PROCESS (54) Bezeichnung: VERFAHREN ZUM ERZEUGEN VON RAUCHAEROSOLEN UND PYROLYSEGERÄT ZUR DURCHFÜHRUNG DES VERFAHRENS		
(57) Abstract A process for generating smoke aerosols for professional projection and checking purposes, and for demonstrating the effectiveness of fire alarm systems, is disclosed, as well as a pyrolysis device for carrying out said process. In a first embodiment of this process, a test object, for example an electric cable or the like, is heated during a defined period in time according to a predeterminable temperature curve, and in a second embodiment, the test object is held at a constant or almost constant temperature. This process allows the course of a real electrical fire to be simulated in a reproducible and time-compressed manner.		

(57) Zusammenfassung

Es wird ein Verfahren zum Erzeugen von Rauchaerosolen zur sachgerechten Projektierung und Überprüfung sowie zur Demonstration der Effektivität von Brandmeldesystemen sowie ein Pyrolysegerät zur Durchführung des Verfahrens angegeben. Bei dem Verfahren wird ein Prüfling, beispielsweise ein elektrisches Kabel oder dergleichen, über eine definierte Zeitspanne gemäß einer ersten Alternative entlang einer vorgebbaren Temperaturkurve erwärmt oder aber, gemäß einer zweiten Alternative, auf einer konstanten oder nahezu konstanten Temperatur gehalten. Durch das erfindungsgemäße Verfahren ist es möglich, einen reproduzierbaren Ablauf eines realen Elektrobrandes mit komprimierter Zeitachse nachzubilden.

LEDIGLICH ZUR INFORMATION

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DESCRIPTION

METHOD FOR GENERATING SMOKE AEROSOLS AND PYROLYSIS
APPARATUS FOR CARRYING OUT THE METHOD

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The invention relates to a method of generating smoke aerosols, particularly for the design, testing or demonstration of fire alarm systems, in which a test material is pyrolysed by heating the smoke aerosols thus being released, and to a pyrolysis apparatus for carrying out this method. For proper design and testing as well as for demonstration of fire alarm systems it is known to carry out smoke tests with a method of the type already mentioned, test material, for example a piece of electrical cable or a board, being heated until a smouldering fire arises during which smoke is generated. As the causes of fires in electrical or electronic installations are always overheating conditions on cables, soldering points or the like, the smoke tests are also carried out with such components as test material. During the design of fire alarm systems the tests serve to ascertain where the detectors are to be located in the electronic installation or in the room in which the installation is positioned. Every installation, and also every room, due to the geometry, differing equipment with electronic and electrical components and due to the most varied types of air conditioning equipment, there are differing flow conditions, which must be taken into



account in the design of fire alarm systems. When testing fire alarm systems the tests enable it to be ascertained whether the detectors installed are still in the correct position in the electronic installation or in the room after, for example, the disposition of the electronic installations in a room has been changed or new ones have been added. Within an electronic switchbox as well, the flow conditions are influenced for example by the fact that a board has been inserted or removed. The VDE Regulation number 0833 prescribes such tests for danger warning systems, i.e. also for fire alarm systems, at regular intervals. Finally, the tests named above serve to demonstrate the effectiveness of a fire alarm system, in order to have a positive influence on the decision of a purchaser to install such a system.

During the occurrence of fires, particularly electrical fires, three basic phases can be distinguished: the pyrolysis phase, in which the low-energy and invisible smoke aerosols are released, the smouldering fire phase, in which visible smoke aerosols are released, and the open fire in which smoke and flames arise. While conventional fire alarm systems, e.g. spot alarms, are activated in the last phase, the range of detection of modern early warning fire systems lies in the two first phases.



The Document DE-OS 22 04 801 discloses a method for generating smoke aerosols in a fire alarm system on the basis of ionisation alarms, in which the components at risk from fire and to be protected, such as boards or
5 cables, are treated with a smoke-generating substance which, when heated to a specific response temperature, releases visible smoke aerosols. These are then detected in a known way by ionisation detectors, and an alarm is triggered.

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The known method for generating smoke aerosols has disadvantages, particularly in its use in early warning fire systems, by means of which the occurrence of an overheating condition is to be detected. The weak
15 point is the release of smoke aerosols, which is not reproducible or only inaccurately, so that it cannot be ascertained with certainty whether the response behaviour of the fire alarm system has changed since the last test or not. A further problem is the
20 unrealistic progress of smoke generation; for this is effected extremely suddenly and at high concentration, whereas in most electrical fires the pyrolysis phase can extend over a period between hours and days, until a smouldering fire with visible smoke development
25 occurs.

The purpose of the invention is to improve a method for generating smoke aerosols of the type already mentioned in such a way that a reproducible burning behaviour is



achieved, as well as to indicate a pyrolysis apparatus for carrying out the method.

- 5 According to the present invention there is provided a method of generating smoke aerosols for planning, testing or demonstration of fire alarm systems comprising pyrolysing a test material by heating the test material to release smoke aerosols, wherein the test material is
10 heated for a specific period of time according to a specific, predetermined temperature curve and wherein a method of generating smoke aerosols for planning, testing or demonstration of fire alarm systems comprising pyrolysing a test material by heating the test material
15 to release smoke aerosols, wherein the test material is heated for a specific period of time according to a specific, predetermined temperature curve, and wherein the specific period of time is fixed in accordance with the required minimum and maximum response times of an early
20 warning fire alarm system.

- The pyrolysis apparatus according to the invention for carrying out this method is characterized by a regular source of electrical current with terminals for connecting
25 to the test material, preferably a sheathed wire, in such a way that the current from the current source flows through it, and by at least one sensor for detecting the temperature of the material, the temperature of the material being capable of regulation in dependence on the
30 period of heating.

- The invention has the advantage that, by means of maintaining a predetermined temperature curve, a reproducible heating of the test material is effected, so
35 that the test results for designing an early warning fire alarm system stand on the same basis, and are comparable with, the test results of monitoring of the system after



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its installation, which is repeated in a yearly cycle.
Whereas in the previous methods described, an
unrealistically rapid increase in

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the concentration of smoke aerosols leads to a rapid saturation of the detectors to be monitored, in the two alternatives of the method according to the invention, a specific temperature curve is produced, which is

5 reproducible at any time, in which visible smoke particles are released in an amount corresponding to the response sensitivity from the design of the early warning fire alarm system. The two alternatives differ in the chronological progress of the temperature of the

10 test material: in one case, the temperature changes during the specific period of time in a likewise specific way, whereas in the other case it is held substantially constant over the specific period of time. The progress of the temperature curve is

15 basically only of secondary importance; on the other hand, the important point is that the curve has a previously defined configuration which is thus reproducible at any time. For example the smoke tests may be carried out on the basis of the so called "Unit

20 Temperature Time Curve" according to DIN 4102 "Burning Behaviour of Building Materials". By means of this unit temperature time count, the fire resistance value of materials is tested, so that it can be desirable to use this temperature curve also as a basis for tests by the

25 method according to the invention.

Advantageous further developments of the invention are specified in the secondary claims.



Whereas the constant or well-nigh constant temperature of the second alternative method can be basically any temperature lying above the pyrolysis temperature of the test material, it preferably corresponds to the
5 smouldering fire temperature of the test material. As in the smouldering fire phase visible smoke aerosols are released, it is possible to use the more reliable optical smoke alarms, while in the pyrolysis phase, in which invisible smoke aerosols are released, ionisation
10 smoke alarms or chemosensors are required.

The specific period of time, in which the test material is heated to the predetermined, time-dependent temperature or is held at a constant or almost constant
15 temperature, is preferably defined by the required minimum and maximum response time of an early warning fire alarm system. This further development enables a particularly precise planning of early warning fire alarm systems.

20

It is of advantage if the specific period of time is preceded by a pre-heating phase, in which the test material is slowly heated up to its pyrolysis temperature. The test material is preferably an e.g.
25 coiled wire, which is sheathed with plastic. The pre-heating phase and the slow heating in this case have the advantage that the plastic does not harden, as would occur during rapid heating by melting and incrustation of the surface of the plastic. The



release of smoke aerosols would be prevented or inhibited by the hardening of the plastic sheathing. Thus this further development of the invention makes an important contribution to the simulation of the real
5 progress of a fire: slow heating of the test material, passage through a pyrolysis phase with release of invisible smoke aerosols, and smouldering fire phase with release of visible smoke aerosols at an amount corresponding to the planned response sensitivity of
10 the early warning fire alarm system. After termination of the specific period of time the smoke test is ended and the pyrolysis apparatus according to the invention switches off automatically.

15 The test material is preferably heated by having an electrical current flowing through it. As direct regulation of its temperature is difficult because of the necessary detection of measurement values, the temperature is set by regulation of the current. The
20 influence of ambient temperature, e.g. by convection, may be minimised by use of a windshield.

The pyrolysis apparatus according to the invention can contain a plate upon which the test material is
25 installed. This enables the pyrolysis apparatus to be used in switchboxes or the like substantially without the necessity to use components of the switch-box for supporting the test structure.



Advantageous is a box-shaped container for receiving the test material, with grid-like or perforated walls, preferably made of metal or metallised. The perforated walls enable the test material to be located without
5 hindrance in the cooling air-flow of an electronic installation.

The metallic or metallised walls give rise to a Faraday Cage, which spatially restricts the electrical fields
10 generated by the heating current in the test material. For this purpose the container is preferably earthed as a whole. This makes it possible to use the apparatus in an electronic installation without the fields arising disturbing the function of the installation.

15

Finally, the pyrolysis apparatus preferably contains a timer for measuring the response time of the early warning fire system to be tested or designed, or whose effectiveness is to be demonstrated. By means of this
20 timer, the period of time between the start of the pyrolysis and the response of the early warning fire alarm system is measured.

A preferred embodiment of the invention will be
25 explained in more detail in the following with reference to a drawing. Shown are:

Figure 1: a temperature configuration during a smoke test, given by way of example;



Figure 2: a plan view of the plate of a pyrolysis apparatus with test material in a box with grid walls; and

5

Figure 3: a side elevation of the plate in the box according to Figure 2.

Referring to Figure 1, the method according to the invention is explained within the framework of a smoke test. The test material is a coiled plastic-sheathed electrical cable (test coil). In a pre-heating phase I it is slowly heated to the pyrolysis temperature (a) of the plastic. Curve 1 shows the temperature progress of this heating over time. Thereafter the temperature of the test material is increased slowly to the smouldering fire temperature (b), and kept constant by regulation over a specific period of time. Measurement of the response time is thus effected between the two points in time 3 and 4, the smoke test being terminated at point in time 4, and the temperature of the test material dropping sharply thereafter. The constant progress of the temperature of the test material in time period II is shown by the curve portion 2. The entire test section II thus corresponds to the pyrolysis phase and to the smouldering fire phase of an electrical fire.

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In order to carry out the method according to the invention, pyrolysis apparatus is used with a source of current which may be regulated, with a terminal for connection to a test coil 6, through which the current
5 from the source flows, with sensors for measuring the current flowing in the test coil 6, and with a microprocessor for regulating this current. According to Figures 2 and 3, the test coil 6 is installed on a plate 5, which is disposed in a box-shaped container
10 with a grid-like base plate 8, cover plates 9 and side walls 10, 11. Due to the grid-like formation of all the walls of the container and also of the plate itself, it is possible to introduce the plate 5 with the test coil 6 into the cooling air stream of an
15 electronic apparatus, without hindering the cooling air stream itself. In order to shield the electronic fields which are generated by the heating current in the test coil 6, all the walls 8-11 of the container consist of metal and are earthed during the smoke test.

20

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CLAIMS



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of generating smoke aerosols for
5 planning, testing or demonstration of fire alarm systems
comprising pyrolysing a test material by heating the test
material to release smoke aerosols, wherein the test
material is heated for a specific period of time according
to a specific, predetermined temperature curve, and wherein
10 the specific period of time is fixed in accordance with the
required minimum and maximum response times of an early
warning fire alarm system.
2. A method according to claim 1, wherein the
15 temperature curve corresponds to a unit temperature time
curve of the test material.
3. A method according to claim 1 or claim 2, wherein
the test material is held for a specific period of time at
20 a constant or substantially constant temperature.
4. A method according to claim 3, wherein the
constant or substantially constant temperature corresponds
to the smouldering fire temperature of the test material.
25
5. A method according to any one of claims 1 to 4,
further comprising a pre-heating stage wherein the test
material is heated slowly to its pyrolysis temperature
prior to being heated for the specific period according to
30 the specific, predetermined temperature curve.
6. A method according to any one of the preceding
claims, in which the test material is heated by an
electrical current flow which passes through the test
35 material, and wherein the temperature of the test material
is determined by regulation of this current.



7. A pyrolysis apparatus for carrying out the method of any one of the preceding claims comprising an adjustable current source and at least one sensor detector for detecting the temperature of the test material, said
- 5 current source having terminals for connection to the test material in such a way that the flow from the current source flows through the test material and through at least one sensor, the temperature of heating of the test material being adjustable in dependence on the heating time.
- 10
8. A pyrolysis apparatus according to claim 7, comprising a box-shaped container for receiving the test material, said container having grid-like or perforated walls.
- 15
9. A pyrolysis apparatus according to claim 7 or 8, comprising a timer for measuring the response time of an early warning fire alarm system to be tested or planned.
- 20
10. A pyrolysis apparatus according to any one of claims 7 to 9 wherein the terminals for connection to the test material are sheathed wire.
- 25
11. A pyrolysis apparatus according to any one of claims 8 to 10 wherein said container is made of metal or is metal coated.
- 30
12. A method as hereinbefore described with reference to any one of the foregoing examples.



13. A pyrolysis apparatus as hereinbefore described with reference to any one of the foregoing examples.

DATED this 3rd day of October, 1997

5

WAGNER ALARM-UND SICHERUNGSSYSTEME GMBH

By their Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent Attorneys of Australia

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METHOD OF GENERATING SMOKE AEROSOLS AND PYROLYSIS
APPARATUS FOR CARRYING OUT THE METHOD

5 There is indicated a method of generating smoke
aerosols for proper planning and testing and for
demonstration of the effectiveness of fire alarm
systems, and pyrolysis apparatus for carrying out the
method. In the method a test piece, for example an
10 electrical cable or the like, is heated over a specific
period of time according to a first alternative along a
predeterminable temperature curve, or, according to a
second alternative, is held at a constant or a well-
high constant temperature. By means of the method
15 according to the invention it is possible to simulate a
reproducible progress of a real electrical fire in a
compressed period of time.

(Figure 1)

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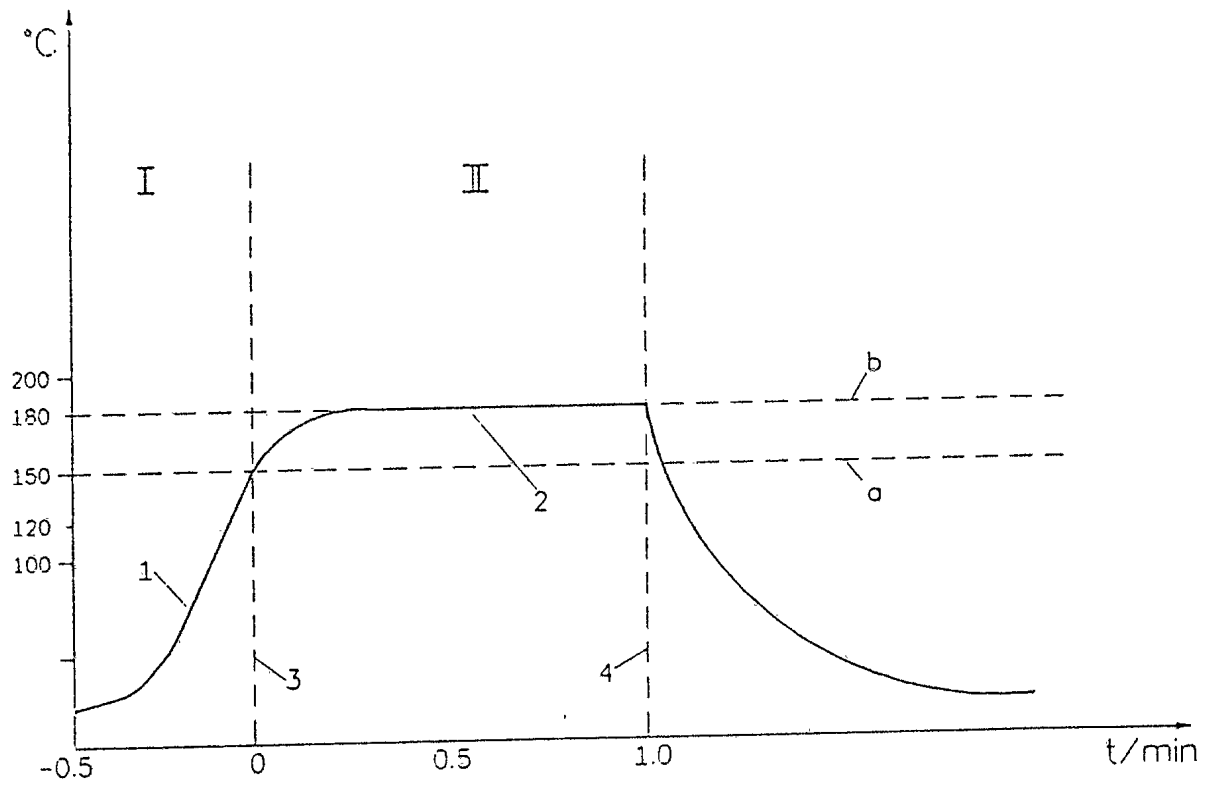


Fig. 1

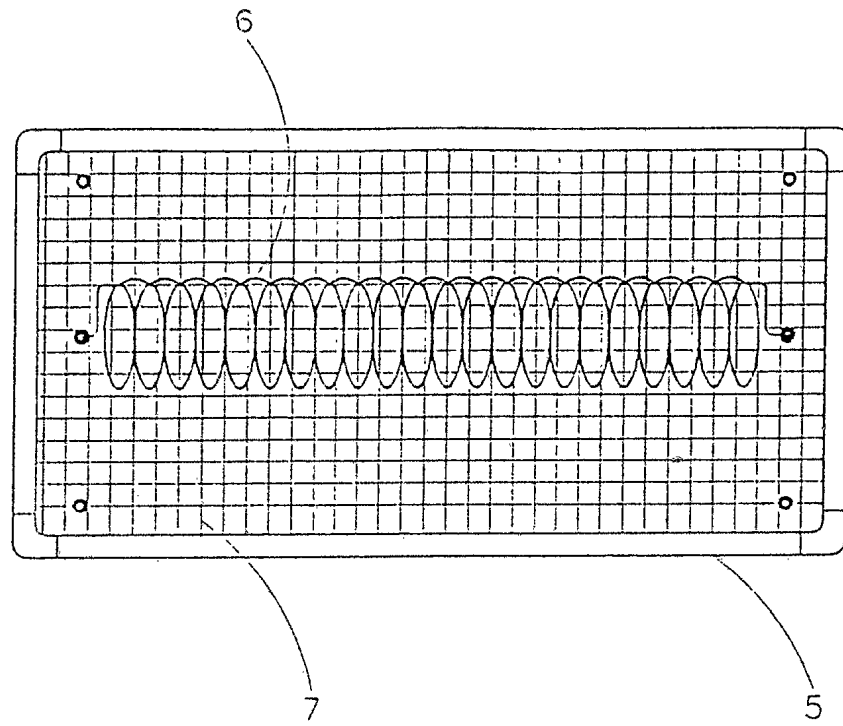


Fig. 2

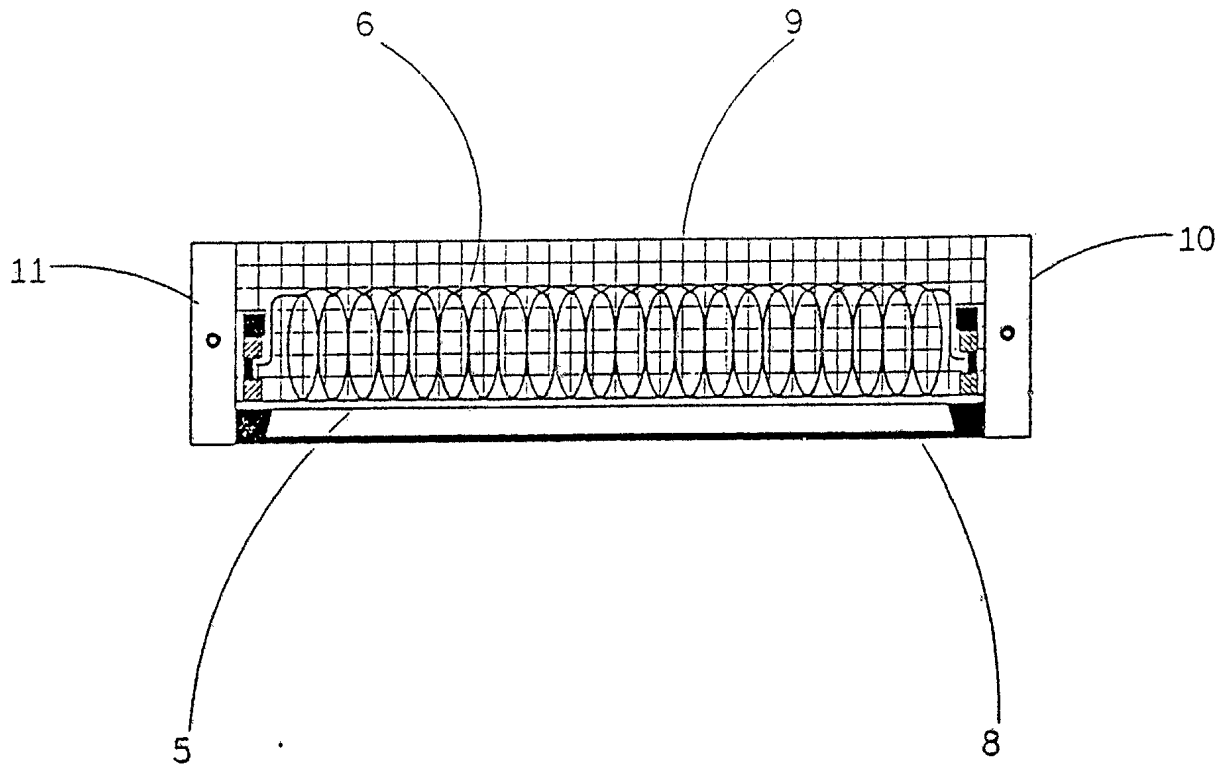


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 94/02917A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G08B29/14

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)

IPC 6 G08B

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,3 729 979 (R. WIBERG) 1 May 1973 see the whole document ---	1-10
X	DE,A,22 04 801 (R. LANGERON) 17 August 1972 cited in the application see the whole document -----	1-10

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"A" document member of the same patent family

Date of the actual completion of the international search

22 December 1994

Date of mailing of the international search report

28.12.94

Name and mailing address of the ISA

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Authorized officer

Sgura, S

INTERNATIONAL SEARCH REPORT

information on patent family members

International application No.
PCT/EP 94/02917

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-3729979	01-05-73	NONE	
DE-A-2204801	17-08-72	FR-A- 2124074 GB-A- 1387144	22-09-72 12-03-75

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 94/02917A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 G08B29/14

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierte Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbol)
IPK 6 G08B

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US,A,3 729 979 (R. WIBERG) 1. Mai 1973 siehe das ganze Dokument ---	1-10
X	DE,A,22 04 801 (R. LANGERON) 17. August 1972 in der Anmeldung erwähnt siehe das ganze Dokument -----	1-10



Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen



Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche

22. Dezember 1994

Absendedatum des internationalen Recherchenberichts

28.12.94

Name und Postanschrift der internationalen Recherchenbehörde
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Fax: (+31-70) 340-3016

Bevollmächtigter Bediensteter

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INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen

PCT/EP 94/02917

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
US-A-3729979	01-05-73	KEINE	
DE-A-2204801	17-08-72	FR-A- 2124074	22-09-72
		GB-A- 1387144	12-03-75