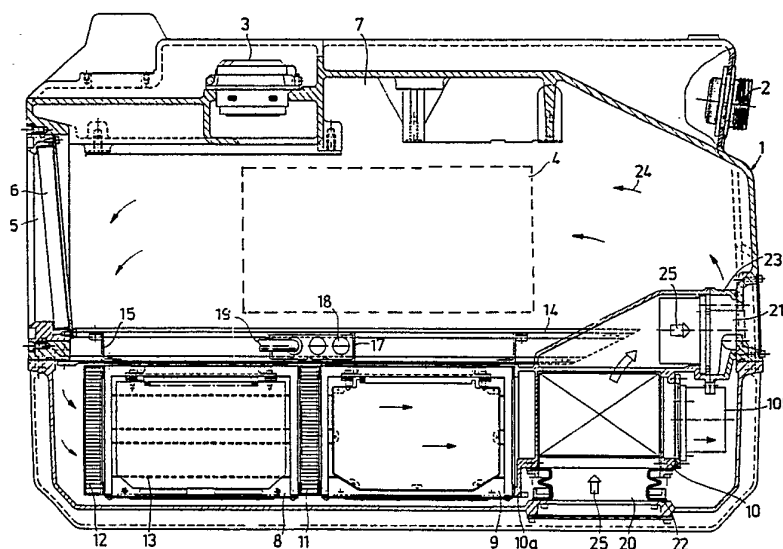




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(54) Title: ARRANGEMENT IN ONE OR MORE UNITS DISPOSED IN AN OUTER UNIT



(57) Abstract

Inner units (8, 9) are disposed in a substantially aseptic space (7) in an outer unit. Each respective inner unit encloses electronic components which are placed on assembly boards stacked upright in the inner units. A cooler unit (10) which is provided with air heat exchanger means occasions circulation of the inner air (24) in the space (7) and, in such instance, leads the inner air past the electric components in the heat exchanger. The cooler unit cools the inner air with the assistance of outer air (25) which is led in through the heat exchanger by the intermediary of an outer air intake (20) and is led off by the intermediary of an outer air outlet (21).

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ARRANGEMENT IN ONE OR MORE UNITS DISPOSED IN AN OUTER UNIT.

TECHNICAL FIELD

The present invention relates to an arrangement for one or more inner units enclosing electronic components, the inner unit or units being disposed in at least one substantially aseptically
5 sealed space within an outer unit. The electronic components are disposed on assembly boards edge-stacked in the inner unit(s).

BACKGROUND ART

One of the contemplated fields of utilization of the present invention is in sighting equipment, in particular ground-based
10 sighting equipment. Such sighting equipment may be employed in conjunction with FEBA ammunition equipment and primarily should consist of portable equipment, which entails that its overall weight must be kept to a minimum.

The above-mentioned sighting equipment includes an optical
15 section which must be disposed dust-free within the sighting unit. The optical section cooperates with an electronic section which is of complex construction and function.

One indispensable requirement placed on the above-disclosed sighting equipment is that it must be possible to keep its outer
20 dimensions at a minimum. This entails, for instance, high packing density for the components in the electronic equipment. In its turn, this involves problems as far as heat generation is



concerned. Excessive heat can damage vital components in the sighting equipment.

BRIEF ACCOUNT OF THE INVENTION

TECHNICAL PROBLEM

5 The above-outlined problems involved in weight and space entail difficulties in disposing the requisite electronics and optics so as to obtain a high degree of functional reliability, meeting the stringent demands placed on the sighting equipment proper.

10 SOLUTION

 One of the primary objects of the present invention is to solve the problem structure as outlined above. The concept forming the basis of the present invention is, here, that the electronics be disposed in the same space as the optical section which, in and
15 of itself, must be allocated an as good as aseptic (for example dust-free) space.

 In more concrete terms, that which may be considered as characterising the novel arrangement according to the present invention is that a cooler unit provided with an air heat ex-
20 changer is operative to cause, in the above-mentioned space, circulation of the inner air in the space and to lead the inner air past the electronic components and the heat exchanger; and to lead outer air located outside the outer unit through the heat ex-
changer and thereby, by means of the outer air, to reduce the
25 inner air temperature or to keep this temperature at a reduced level.

 In further developments of the inventive concept as herein disclosed, it is more closely borne in mind how the cooler unit is to be disposed together with one or more inner units in the above-
30 mentioned space. In such instance, the cooler unit may be mounted together in series with an inner unit. In such cases as involve two or more inner units, the interconnected modules make a row which is placed along the one inner bounding side of the outer unit. Preferably, each respective inner unit and the cooler unit
35 are separated by filters against electromagnetic impulse. At its free end, the outermost located inner unit in the row is, in such an instance, also provided with a filter of the above-mentioned type. Such filters are previously known in this art and may

consist of so-called honeycomb filters. In the present case, a characteristic feature of the filter is that it make possible the passage of inner air for cooling the electronic components at the same time as constituting an effective barrier to sn electro-
5 magnetic interference (EMI), in question.

The present invention further embraces the concept of how the upright stacked boards are to be applied in each respective inner unit. Thus, it is possible to employ frames which each carry two boards disposed in parallel on either side of the frame. The
10 frame, and the two boards carried thereby, are disposed such that the circulated inner air may pass on either side of each respective board. This function may be attained in that the frame is constructed of cross-pieces of reduced cross section, thus making for the passage of inner air.

15 One embodiment of the present invention also considers the arrangement and disposition of the external electric connection to the electronic components disposed within the units. Each respective inner unit may include an EMI disturbance-free connection unit. One preferred embodiment of the present invention
20 calls for the employment of an extension section of each respective inner unit, this extension section including a lift-off side member. Each respective electric connection unit is provided with one or more recesses for connection cables. A metal casing is disposed in each respective recess, in which a screen or guard on
25 each respective connection cable may be anchored. In such a situation, the sleeve, guard, connection unit are disposed so as to ensure freedom of disturbance from electromagnetic interference (EMI).

Each respective unit is of metal/alloy. In one preferred
30 embodiment, connection strips are disposed at the bottom of each respective unit. The frames with their associated boards are loaded into the unit from above and the electric connection devices of the boards are united with their corresponding devices in the above-mentioned connection strips. The base portion on each
35 respective board is provided with electric lead-ins so that the internal mutual connection may be established with the electric connection devices disposed on the outside of the inner unit. The

electric connection contemplated here may be effected in a per se known manner, for example by the intermediary of bars, wire connection leads etc.

ADVANTAGES

5 As a result of the above-proposed construction according to the present invention, it will be possible to attain a high packing density of the electronic components without heat generation occasioning any disturbance to the overall function of the equipment proper. Moreover, the electronic equipment will be
10 EMI-guarded. The dimensions of the outer unit can be kept at a minimum.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The nature of the present invention and its aspects will be more readily understood from the following brief description of
15 the accompanying Drawings, and discussion relating thereto in respect of a currently proposed embodiment of an apparatus according to the present invention which displays those characteristics significant of the invention.

In the accompanying Drawings:

20 Fig. 1 shows, in horizontal section, one embodiment of an outer unit and inner units disposed therein together with a cooler unit; and

Fig. 2 is an oblique perspective panoramic view of the detailed construction of the inner units and cooler units.

25 DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the Drawings, Fig. 1 shows the disposition of the optics section and the electronics section in portable sighting equipment which is to be employed in conjunction with the firing of missiles, rockets etc. The sighting equipment comprises
30 essentially an outer unit 1. This unit is provided int. al. with two connections 2 and 3. The outer unit is intended to be supported on a frame or the like (not shown on the Drawing). Since the configuration and construction of the outer unit may differ, it will not be described in greater detail here.

35 The outer unit encloses a symbolically indicated optical section 4 whose exit aperture is indicated 5. A lens 6 is disposed in the aperture. The inner space of the outer unit is shown by

reference number 7. This space must be kept in a substantially aseptic - i.e. contaminant-free such as dust-free - state and the outer unit is sealed-off for this purpose.

Viewed along one inner bounding side, there is disposed in
5 the outer unit electronic equipment in two inner units 8 and 9. For cooling the electronic equipment in the inner units, use is made, according to the invention, of a cooler unit 10 which may operate according to per se previously known principles. Hence, the cooler unit comprises a cross-current heat exchanger (not
10 shown in detail) and a fan motor (not shown in detail). The units 8, 9 and 10 are disposed in a row. The cooler unit 10 is integral with the inner unit 9. The inner units are disposed with an interjacent EMI barrier filter 11. At its free end, the inner unit is provided with a filter 12, corresponding to the filter 11.

15 The electronic equipment substantially comprises components which are disposed on assembly boards 13 stacked upright and oriented in a direction which coincides with the file of the units 8, 9 and 10. The boards 13 may be loaded down into each respective unit from the upper sides thereof. The boards display per se known
20 electric connection devices (connection strips) which may be interconnected with corresponding electrical connection devices (connection strips) on the bottom side of each respective inner unit. Within the outer unit 1, there is disposed an assembly bar 14 in which the inner units 8 and 9 are anchored by the
25 intermediary of anchorage members (profiles) 15. The cooler module is fixedly mounted in the unit 9 by the intermediary of a connection flange 10a. This connection may be effected in a per se known manner. In the embodiment according to Fig. 1, the units 8 and 9 may be united by their connection devices 17 which are
30 provided with connection apertures 18 for a symbolically indicated outer cable 19. The cooler module is also fixedly retained in the outer unit 1 by the intermediary of its air intake 20 and exhaust outlet 21. The air intake 20 is suspended in a resilient rubber bellows device 22 and the air discharge outlet 21 is anchored by
35 the intermediary of its flange 23.

On its activation, the fan motor (not shown in Fig. 1) will occasion a circulation of the inner air in the space 7. This circulation is indicated on the drawing by single-bodied arrows 24. The inner air circulates via the optics 4, the filter 12, the unit 8, the filter 11, the unit 9 and the inner exhaust outlet 10b of the cooler unit and back towards the optics 4, and so on. The circulating inner air will sweep along the short sides supporting the components and over frames which support the boards in question in accordance with that described below. Moreover, the fan motor (not shown) will draw in outer air located outside the outer unit 1 by the intermediary of the intake 20, and lead this outer air through the cross-current heat exchanger and out via the exhaust outlet 21. The outer air flow is indicated by the block arrows 25. Thus, the inner air will be employed as a medium for transporting heat from the electronic components to the cross-current heat exchanger, where the heat is lead off by means of the outer air 25.

Fig. 2 shows a detailed embodiment of the units 8, 9 and 10. The units 8 and 9 are of metal/alloy. In this case, the connection device 17' is of a modified design in relation to the embodiment according to Fig. 1. The connection device 17' includes a removable side section which, in Fig. 2, has been removed from the unit 9. The connection device includes electrical connection devices 26 which may be constructed according to the jack plug connection principle. The connection devices or contactors may be of the type as includes wafer contactors whose electrical contact surfaces are insertable in corresponding contactor devices, connection bars, on the bottom portion of the connector device 17'. The contactor devices 26 are connected to the outer power supply connection (cf. 19 in Fig. 1). This outer connection is effected by the intermediary of sleeves 27 of metal in accordance with the above disclosure.

The boards which carry the electronic components may, in cases of extremely high packing density, be of the type known in this art as ceramic boards. The boards are disposed on frames preferably of metal, these including two parallel outer sections 28, 29 (28 being the uppermost), a central section 30 disposed in

parallel with the above-mentioned outer sections and a number of crosspieces 31 interconnecting the above-mentioned outer and intermediate sections. The above-mentioned outer and intermediate sections extend in the longitudinal direction of the board and the above-mentioned crosspieces in the transverse direction of the board. One such frame mounts two boards, one on each side. In this instance, these crosspieces 31 are of reduced cross-section, thus making it possible for the inner air, on this circulation by means of the cooler unit, to pass on both sides of the board. Not only will the temperature of the boards and the components be reduced by means of the circulating inner air and the above-mentioned outer air, but also the frames will be cooled by the inner air in question.

The inner units consist of wafer-walled box units of metal/alloy. The frames with boards mounted thereon are loaded down from the upper side of each respective unit. To this end, each respective unit is provided with a wafer-walled removable lid.

Assembly of the boards on the frames may be effected by means of anchorage devices (not shown in detail) e.g. screws or the like. This technique is per se known in the art and will not, therefore, be described more closely here. The boards per se are also previously known in the art.

The invention should not be considered as restricted to that embodiment described above and shown on the drawings, many modifications being conceivable without departing from the spirit and scope of the appended claims.

WHAT WE CLAIM AND DESIRE TO SECURE BY LETTERS PATENT IS:

1. An apparatus in one or more inner units (8, 9) enclosing electronic components, and being disposed in one at least substantially aseptically sealed space (7) within an outer unit (1), said electronic components being placed on assembly boards stacked upright in said inner unit (inner units), characterised in that a cooler unit (10) provided with an air heat exchanger is disposed to occasion, in said space (7), a circulation of the inner air (24) in the space (7) and lead the inner air past the electronic components and heat exchangers, and to lead outer air (25) located outside the outer unit (1) through the heat exchanger and thereby, with the assistance of the outer air (25) reduce the temperature of the inner air or hold said temperature at a reduced level.

2. The apparatus according to claim 1, characterised in that the cooler unit (10) is assembled in series with the inner unit, or respectively with one of the inner units; and that each respective inner unit is provided, on its air-intake side, with a filter which is permeable to the inner air but is operative as a barrier to electromagnetic interference (EMI).

3. The apparatus according to claim 2, characterised in that in the case involving two or more inner units (8, 9) interconnected in a mutually subsequent row, these are separated by filters (11) permeable to the inner air but operative against electromagnetic impulse; and that the outermost-located inner unit is provided, at its free end, with a filter (12) corresponding to said filter.

4. The apparatus according to claim 1, 2 or 3, characterised in that the upright-stacked boards in each respective unit (8, 9) are oriented in the same direction as the direction of composition of the cooler and inner units.

5. The apparatus according to any one of the preceding claims, characterised in that the assembly boards are disposed on frames (28, 29, 30, 31) which each carry two boards which are disposed in parallel and are placed on either side of the frame in question; and that the frame is there disposed so as to allow the inner air (24) to pass on both sides of each respective board.

6. The apparatus according to claim 5, characterised in that each respective frame carries two mutually parallel outer sections (28, 29) and a central portion (30) which is parallel to the outer sections; that said sections are interconnected with crosspieces
5 (31) which are, between the outer and intermediate sections, of reduced section which allows the inner air (24) to pass on either side of boards fixedly retained on the frames.

7. The apparatus according to any one of the preceding claims, characterised in that each respective inner unit (8, 9) is
10 provided with a connection device (17) for outer electric connection (19) of the electronic components.

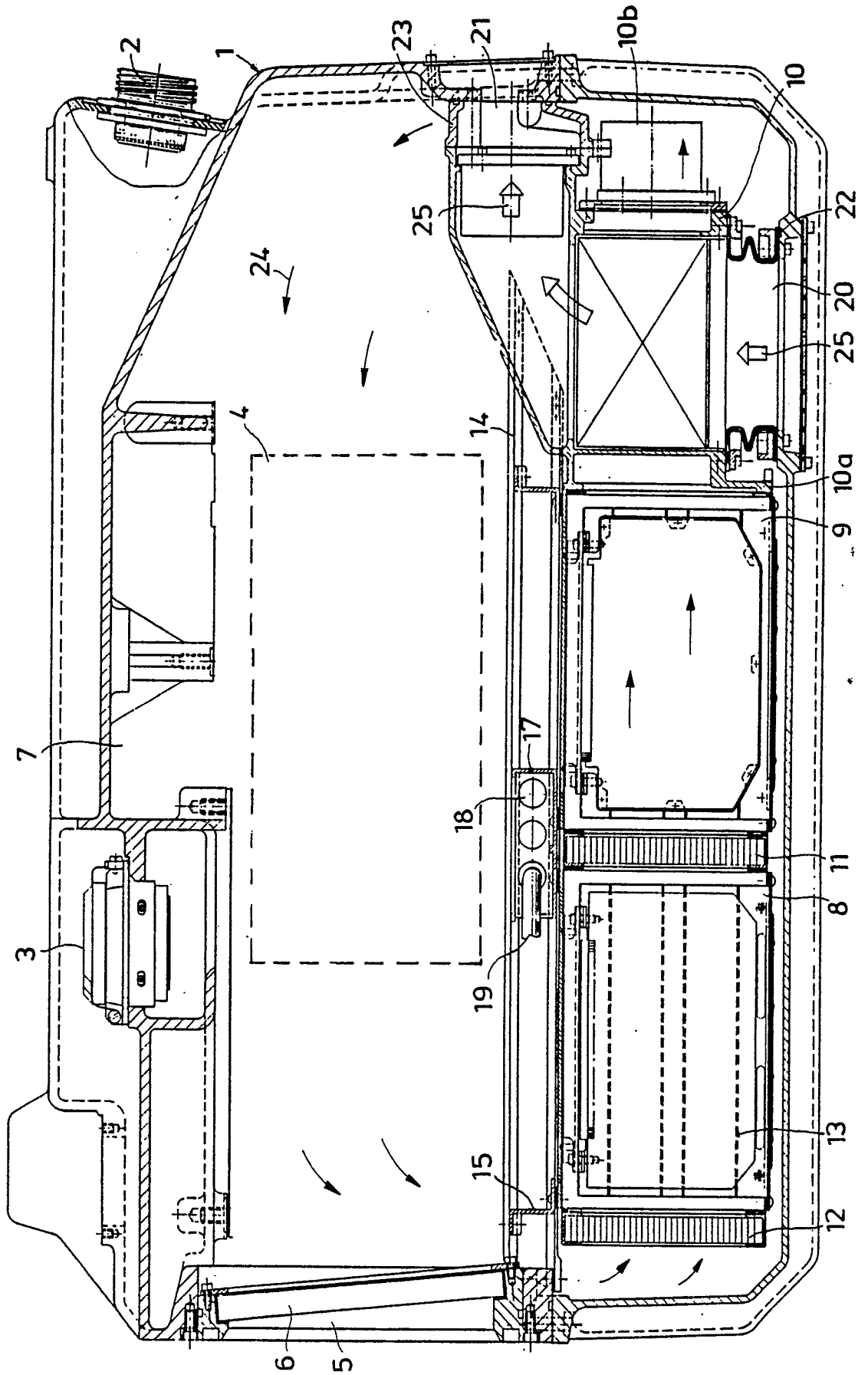
8. The apparatus according to any one of the preceding claims, characterised in that each respective inner unit encloses its associated electronic equipment and the connection thereof
15 disturbance-suppressed against EMI at the same time as efficient cooling is effected of the electronic components.

9. The apparatus according to claim 7 or 8, characterised in that each respective inner unit with associated electric connection device (17) is of metal/alloy; and that the electric
20 connection is effected by the intermediary of metal-screened connection conduits (19) which are led into each respective inner unit by the intermediary of one or more connection sleeves (27) of metal.

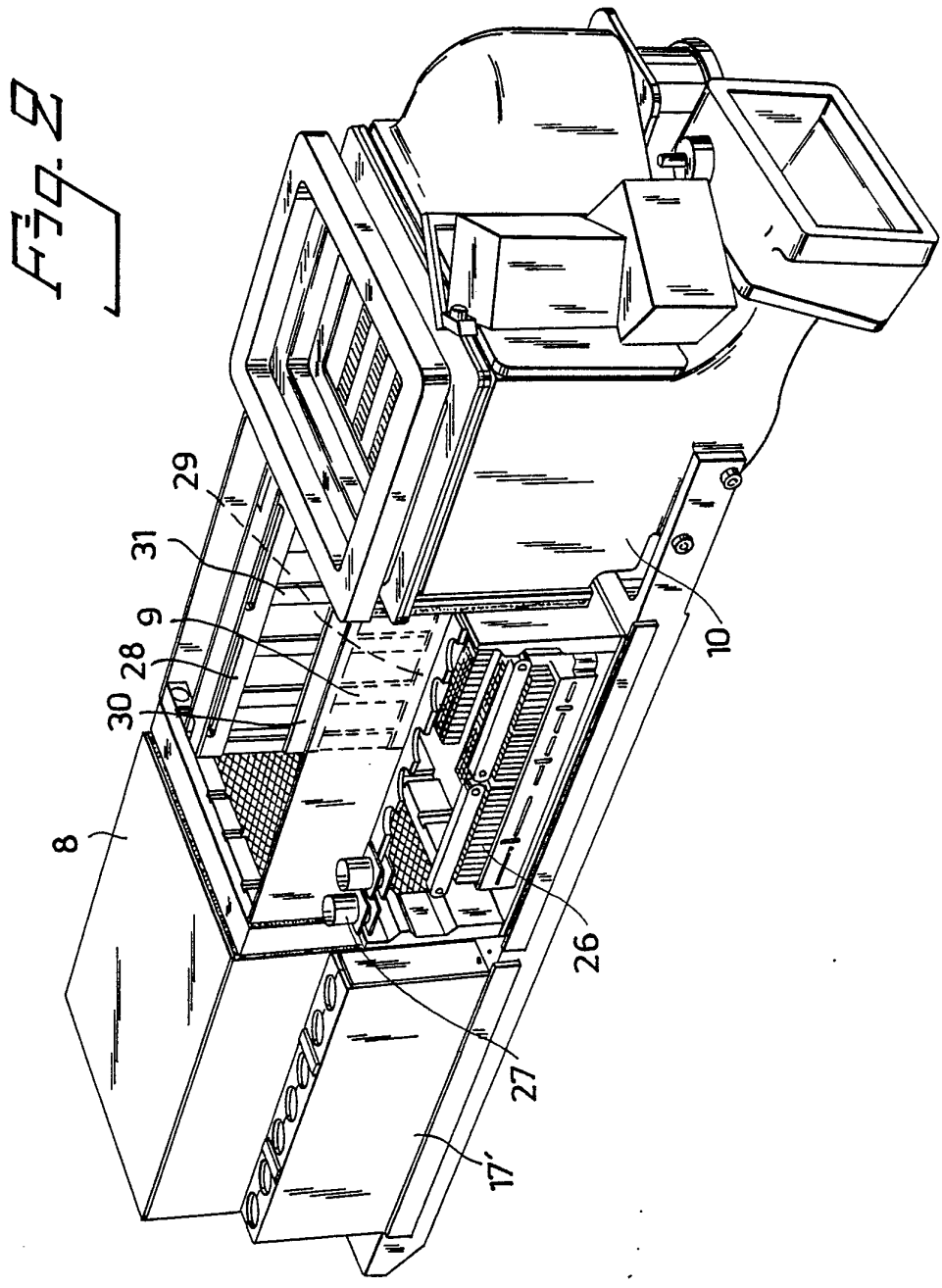
10. The apparatus according to any one of the preceding
25 claims, characterised in that corresponding means cooperating with the electric connection devices to the upright stacked boards, e.g. connection bars, are disposed in parallel on the bottom section of each respective inner unit; that the latter is provided with electrical lead-ins which are mechanically sealed against the
30 remainder of the material constituting the bottom portion such that a disturbance-guarded enclosure for the electronic component is also present here; and that the electric lead-ins are mutually electrically interconnected on the outside of each respective inner unit.

1/2

Fig. 1



SUBSTITUTE SHEET



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00443

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 ⁴ H 05 K 7/20, 5/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4 US CI	H 05 K 5/00, /02, /03, /04, /06, 7/20 <u>361:380-385</u>	
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	IBM Technical Disclosure Bulletin Vol 8, No 11, page 1692 April 1966.	1
A	IBM Technical Disclosure Bulletin Vol 28, No 7, page 3223 December 1989	1, 2
X	FR, A, 2 078 558 (SIEMENS AKTIENGESELL- SCHAFT) 5 November 1971 & DE, 2006759 CH, 525598 AT, 303814	1, 3
X	"Derwent's abstract No. G4574C/30, SU 700 941, IMANOV AB 5 December 1979	1, 4
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1986-12-15	1986 -12- 19	
International Searching Authority	Signature of Authorized Officer	
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