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(71) Applicant: **van Putten, Simon Cornelis**
Lekdreef 20
NL-2931 AH Krimpen a/d Lek(NL)

(72) Inventor: **van Putten, Simon Cornelis**
Lekdreef 20
NL-2931 AH Krimpen a/d Lek(NL)

(74) Representative: **Fieret, Johannes, Ir. et al**
c/o Algemeen Octrooibureau P.O.Box 645
NL-5600 AP Eindhoven(NL)

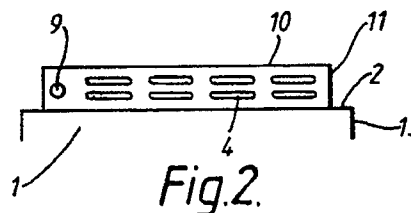
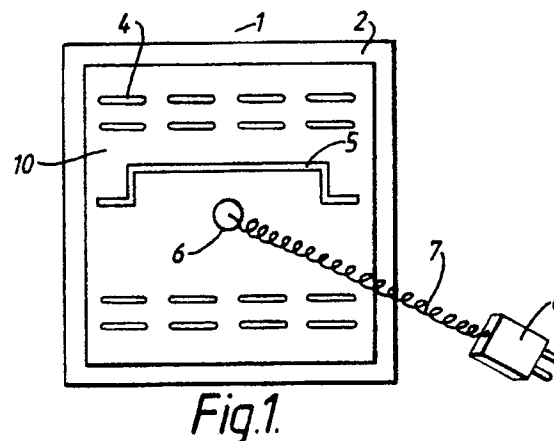
(54) **Ballast for one or more external fluorescent lamps and lighting fixture for fluorescent lamps having no ballast apparatus.**

(57) A device for operating external fluorescent lamps, said device comprising a housing accommodating apparatus for igniting and letting burn, by means of high frequency lines, fluorescent lamps coupled to the device, which apparatus can be coupled to an external electric power source by means of an electric feeder cable.

A lighting fixture comprising a housing which is provided with one or more fluorescent lamp holders, as well as high frequency coupling means connected thereto.

A ballast for fluorescent lamps, with ballast apparatus for one or more external fluorescent lamps.

A lighting fixture for fluorescent lamps not comprising ballast apparatus, which may be provided with one or more high frequency lines.



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BALLAST FOR ONE OR MORE EXTERNAL FLUORESCENT LAMPS AND LIGHTING FIXTURE FOR FLUORESCENT LAMPS HAVING NO BALLAST APPARATUS.

The invention relates to a device for operating several fluorescent lamps located outside said device. The invention also relates to a lighting fixture comprising a housing which is internally provided with one or more lamp holders for one or more fluorescent lamps.

A lighting fixture of the kind just mentioned is generally known and comprises, accommodated within the housing, all the apparatus necessary and possibly desirable for igniting and letting burn one or more fluorescent lamps, such as electromagnetic ballast apparatus and starters on the one hand, and compensating and anti-interference capacitors on the other hand.

Both the necessary and the desirable apparatus may be replaced by available electronic ballast apparatus, but in practice said electronic ballast apparatus is hardly, if at all used, in spite of the energy saving and extension of the life of the fluorescent lamps made possible by said apparatus. The reasons for this are the lower light flux delivered by the fluorescent lamps when electronic ballast apparatus is used, and the fact that electronic ballast apparatus is sensitive to failure as a function of the heat generated inside the housing.

The disadvantages of electromagnetic ballast apparatus are the generation of heat, the occurrence of leakage fields which cause the housing, which is for example made of sheet steel, to resonate, resulting in noise, and the significant amount of space said apparatus takes up in the housing.

It is an object of the present invention to overcome the drawbacks of the electromagnetic ballast apparatus in lighting fixtures for fluorescent lamps.

Another object of the invention is to render the use of electronic ballast apparatus in lighting fixtures for fluorescent lamps more feasible.

Yet another object of the invention is to provide a more flexible and versatile lighting system with lighting fixtures for fluorescent lamps for larger spaces, such as offices having ceilings made of prefabricated parts.

These objectives are accomplished by a device of the kind mentioned in the preamble, comprising a housing accommodating at least part of the apparatus required for igniting and letting burn fluorescent lamps coupled to said device by means of high frequency lines, said device being arranged for coupling, by means of an electric feeder cable, the apparatus inside the housing to an electric power source outside the device.

The apparatus accommodated in the housing may comprise electromagnetic ballast apparatus and starters, compensating and anti-interference

capacitors, or electronic ballast apparatus.

In case electromagnetic ballast apparatus is used the housing may be made of a material which is insensitive to magnetic leakage fields, aluminium for example, which would be too costly for use in lighting fixtures, or a heat resistant plastic material.

Lighting fixtures connected to the device may be switched selectively by connecting said lighting fixtures to a switching installation, via an electric switch cable which is coupled to the apparatus accommodated in the housing. Furthermore an electric feeder cable is coupled to said apparatus, in order to connect the device to the electric power source, usually the public electricity network. Furthermore the device according to the invention is connected, by means of high frequency lines, to a plurality of lighting fixtures for fluorescent lamps. Said cables and lines may be connected to the apparatus present inside the housing by means of electric connecting means, such as connectors, plugs and flush-mounted coupling sockets.

Furthermore an emergency supply device, for example a pair of nickel cadmium batteries and the electronics associated therewith, may be accommodated in the housing. One or more sensors may furthermore be mounted on the housing, said sensors being connected to the apparatus inside the housing in order to control the operation of said apparatus, for example turning fluorescent lamps on and off.

The housing is furthermore provided with vent holes and may be portable, whereby the construction of the housing may furthermore be such that it can be suspended. The housing may also be adapted to the dimensions of a prefabricated ceiling tile, and may have one surface with an aesthetic finish, i.e. matching the appearance of said prefabricated ceiling tiles.

In order to accomplish the aforesaid objectives the invention also provides a lighting fixture of the kind mentioned in the preamble, which is characterized in that the housing is furthermore provided with means connected to the lamp holder(s), which make it possible for the lamp holder(s) to be coupled to a device according to the invention by means of one or more high frequency lines.

Due to the absence of ballast apparatus in the lighting fixtures for fluorescent lamps a better thermal control is achieved, resulting in a lower temperature around the lamp and in an effective gain in light flux, which largely compensates for the lower light flux of fluorescent lamps in the case of electronic ballast apparatus being used. The improved thermal control in the lighting fixture will

lead to a prolonged life of the fluorescent lamp(s). Also the extent in which electronic ballast apparatus is sensitive to failure depends on the generation of heat. By accommodating said electronic ballast apparatus in a separate housing, which may have a considerably larger ventilating capacity than is possible with the lighting fixtures for fluorescent lamps used in practice, the sensitivity to failure of the electronic ballast apparatus will be reduced and the life of said apparatus will be prolonged.

As already said before, the present invention may be used advantageously for lighting modulated rooms, such as rooms in offices. In that case the ballast for fluorescent lamps according to the invention contains all ballast apparatus for the lighting fixtures for fluorescent lamps which is required for a certain office segment.

The ballast according to the invention may readily be mounted, without any risk, on the sections of modulated prefabricated ceilings, without any tools being used. Flush-mounting the ballast does not require a greater depth than is needed for lighting fixtures.

Possibly the ballast may be attached to the ceiling or on the wall. It is not necessary hereby to screw down the ballast. It may also be decided to suspend it by means of two hooks. In other words, the ballasts may readily be surface-mounted or be suspended from the wall or the ceiling.

In October 1989 Dutch regulations did not allow the maximum length of high frequency lines to exceed 350 cm, which implies that in case these regulations are still to be complied with, it must be possible, if the ballast is centrally disposed with respect to lighting fixtures, to supply as many lighting fixtures as necessary within a radius of 350 cm from the ballast. The housing of the ballast is thereby provided with terminals, for example so-called master sockets, for interconnection to lighting fixtures, whose housing may likewise be provided with master sockets.

In case the ballast is used in for example modulated office spaces a considerable installation advantage is thus achieved, since only one mains connection, located as centrally as possible, needs to be placed at the location of the ballast. The lighting fixtures may thereby be connected individually, by means of a switching installation adapted thereto. The ballast is thereby provided with a multi-core cable with a plug adapted to said switching installation. In the latter case the separate switching of lighting fixtures, even of several fluorescent lamps present therein, is facilitated.

When walls are moved in order to make office spaces larger or smaller, the lighting devices, which may have different arrangements, can readily be interchanged. The fact is that when one department is made smaller, another department

automatically becomes larger. In order to interchange the ballasts it is only necessary to interrupt the power supply and to disconnect the interconnections or high frequency lines. All this can be done by pulling out the plugs or connecting means used. Re-installing them only takes a few minutes, therefore, especially when ceilings made of prefabricated parts are used, which is common practice, with visible sections, whereby the tile can be removed in a simple manner at the location of the lighting device. As already said before the ballast operates inaudibly and it is not visible from the office space. In this manner a very flexible lay-out of a modern office building is achieved, with minimal adaptation costs and low operating costs. In particular with regard to the rented offices sector the advantage will be obvious.

As already said before, the ballast may be built the size of a modulated ceiling tile. Of course the ballast will be visible in that case, but its finish will have been adapted to match the ceiling.

A further advantage is that as a result of the low installation costs and the relatively high effective light flux obtained by using ballasts and lighting fixtures according to the invention, the use of electronic ballast apparatus in lighting installations becomes affordable, as a result of which the primary advantages of electronic ballast apparatus, an energy saving of about 25% compared with electromagnetic ballast apparatus, and an extension of the life of the lamp by more than 100%, can fully be utilized. Thus the invention may assist in the effort to put less strain on the environment.

The ballast according to the invention may furthermore be provided with all kinds of sensors and timer units for the switching of fluorescent lamps. The ballasts may also be provided with dimmable high frequency ballast apparatus, whose dimming may be done both via normal dimmers, special dimmers and light-sensitive cells in the shape of daylight-dependent switching systems.

An additional advantage is furthermore that in case of a failure the ballast can readily be replaced, by exchanging it for a spare ballast. Then the ballast can be repaired in the workshop without any interruption and with a minimal loss of operating time. For a large office building one or maximally two ballasts, each having a predetermined number of connections, will do to cope with technical failures and to readily effect repairs.

The invention will be described in more detail hereinafter by means of an example of an application in office buildings, to which application the invention is not limited, of course, and with reference to the drawing, in which:

Figure 1 is a plan view of the housing of a ballast according to the invention;

Figure 2 is a side elevational view of the hous-

ing according to Figure 1;

Figure 3 is a bottom view of the housing of Figures 1 and 2;

Figure 4 shows the arrangement of an office segment in accordance with the present invention;

Figure 5 shows surface-mounting of the ballast according to the invention; and

Figure 6 shows surface-mounting of the ballast according to the invention, said ballast replacing a ceiling tile.

In Figures 1 - 3 and 5 a first possible embodiment of a ballast, at least substantially its housing, is indicated by reference numeral 1. Said housing 1 accommodates at least part of the electromagnetic, for example, ballast apparatus, but preferably all of said apparatus, such as, besides the electromagnetic ballast apparatus, also starters and compensating and anti-interference capacitors or electronic ballast apparatus, necessary and possibly desirable for igniting and letting burn several fluorescent lamps. The latter additional apparatus may for example comprise one or more sensors and electronics associated therewith for, possibly selectively, switching fluorescent lamps on and off. Also the compensating and anti-interference capacitors may be considered to be additional apparatus. When electromagnetic ballast apparatus is used the housing 1 is preferably made of a material which is insensitive to the magnetic leakage field of the electromagnetic ballast apparatus, such as aluminium or a suitable plastic material.

The invention does not relate to the aforesaid apparatus, components and electronics, nor to electric connecting means and electric connectors, such as as high frequency lines per se, so that these are not shown in the drawing and/or will not be discussed in the description. It is noted - perhaps unnecessarily - that a person skilled in field of the art to which the present invention relates will have no problems in purchasing or making (or having them made) the means for implementing the teachings of the invention.

Referring again to Figure 1 - 3, the housing 1 is provided with a bottom plate 2, an upper plate 10 and side plates 11. Said plates 2, 10 and 11 all have vent holes 4, whose number and shape naturally depend on the amount of heat generated inside the housing which, when electromagnetic ballast apparatus is used, will be larger than when electronic ballast apparatus is used. A collapsible handle 5 is furthermore provided on the upper plate 10 of the housing 1, by means of which handle the housing 1 can be carried. Said handle 5 is not essential, but it may be effectively used with the application shown in Figures 5 and 6, and may otherwise be desirable. As already said before, the housing 1 may be suspended, for example analo-

gous to a painting, by using means intended for that purpose. Figures 1 - 2 finally illustrate, only quite diagrammatically, electric connecting means, 6 and 9 respectively. Said electric connecting means 6 is to be coupled to an electric supply cable provided with complementary connecting means (not shown), for example the heat resistant mains cable 7 with plug 8 shown in Figure 1. The electric connecting means 9 is to be coupled to a high frequency line (not shown) provided with a complementary electric connecting means (not shown). Each side plate 11 of the housing 1 may be provided with one or more such high frequency connecting means 9. Said coupling by way of electric connecting means 6, 9 is not essential, but effective. The mains cable 7 may also be fixedly connected with the apparatus within the housing 1. This may also apply to the high frequency lines. The apparatus accommodated inside the housing 1 may also be coupled to a switching installation (not shown) other than the ballast according to the invention, by means of an electric switching cable (not shown), analogous to the electric feeder cable 7.

As shown in Figures 2 and 5, the bottom plate 2 of the housing 1 has an edge 3, consisting of a square bend in the illustrated embodiment. The dimensions of the bottom plate 2 of the casing are thereby adapted to correspond with the distances between the sections 12 of a prefabricated ceiling, a small part of which is shown in Figure 5. The sections 12 which are visible in Figure 5 carry a ceiling element, a mineral tile 13 in the illustrated embodiment, and also a ballast 1 according to the invention.

Figure 6 shows that when a correspondingly dimensioned bottom plate 2 is used, the housing 1 may take the place of a mineral tile 13, whereby the need for an edge 3 (Figures 2 and 5) is no longer there, but whereby preferably the surface 21 of the bottom plate 2, which is visible from the room to be illuminated, has an aesthetic finish, in particular matching the ceiling elements 13 and lighting fixtures for fluorescent lamps (not shown in Figure 6).

The lighting fixtures for fluorescent lamps (not shown in the drawings) are different from the conventional and known lighting fixtures, in that they do not incorporate any switching apparatus and other desirable apparatus, but possibly part thereof; the aforesaid silent lighting fixtures according to the invention. A lighting fixture in accordance with the present invention will comprise one or more fluorescent lamps, one or more tube holders and high frequency lines connected to the lamp holders. The high frequency lines may thereby be led outside the housing of the lighting fixture, or be connected to electric connectors, analogous to the connecting

means 9 in the housing 1 of the ballast proposed. At present it is preferred to effect the high frequency coupling between a ballast 1 according to the invention and a plurality of lighting fixtures according to the invention by means of high frequency lines, which are on both sides provided with electric connecting means. When the regulations in force in The Netherlands in October 1989 are to be met the maximum length of said high frequency lines may not exceed 350 cm. Correspondingly a mains cable should not be longer than 200 cm. Hereinafter the maximum length of the high frequency lines is assumed to be 350 cm.

The boxed-in part in Figure 4, indicated by reference numeral 15, illustrates an office segment of 720 x 720 cm (with a maximum length of the high frequency line of 350 cm) which can maximally be covered by a ballast 1 which is only very diagrammatically indicated in Figure 4. Reference numeral 14 diagrammatically indicates elongated fluorescent lamps 14 or fixtures. The distance between parallel fluorescent lamps 14 is 240 cm, whilst the distance between the centres of the fluorescent lamps is 180 cm. A maximum of 12 fluorescent lamps 14 or fixtures can be placed, therefore, assuming that the ballast 1 can be placed centrally or approximately centrally above the lowered prefabricated ceiling.

The above central location of the ballast 1 according to the invention entails a considerable installation advantage, since only one centrally located mains connection needs to be installed at the location of the ballast 1. As already said before the lighting fixtures 14 can be switched individually by means of an installation adapted thereto.

When walls are moved in buildings, in order to make rooms smaller or larger, the ballasts 1 can readily be interchanged. Indeed when one of the rooms within a total space is enlarged, another room within the total space will automatically become smaller. In order to interchange the ballast 1 only the feeder cable 7 and one or more high frequency lines of the ballast 1 need to be disconnected. Re-installing them only requires a few minutes, therefore, especially when prefabricated ceilings are being used, which is common practice, said ceiling having visible sections, whereby the tile 13 can simply be taken out at the location of the ballast. In this manner a larger flexibility in the lay-out of a modern office building is obtained, with minimal adaptation costs and low operating costs. In particular with regard to the rented offices sector anyone the advantage will be obvious.

As regards the lighting fixtures according to the invention it is furthermore noted that they may be made lower in many cases, since they only contain a housing with reflectors/refractors and one lamp holder, when compact fluorescent lamps are being

used, or two lamp holders when elongated fluorescent lamps having a diameter of for example 26 mm are being used. A technical advantage thereby is that when calculating the radii of an optics in the housing of the fixture it is no longer necessary to take into account the space the ballast apparatus would take up.

The regulations in force in The Netherlands in October 1989 prohibit the presence of air vents in the bottom of the housing of the lighting fixture, at the location of the ballast apparatus. In case no ballast apparatus is present air vents may be provided in the bottom of the housing, at the location of the space that has become available, which results in an improved thermal management and a higher light flux of the lamp at operating temperature, and indirectly in a longer life of the fluorescent lamp. Moreover, the air exhaust capacity of the lighting fixture is increased in a responsible manner, whilst the bottom area of the housing remains constant.

When the available depth in the lowered ceiling is insufficient for flush-mounting the ballast, said ballast may be semi-flush-mounted, with an attractively shaped housing 1, whereby for example said depth may be limited to a maximum of 24 mm, instead of 36 - 88 mm in other cases. When the ballast is suspended from a ceiling, it is preferably arranged in such a manner that it takes up a vertical position.

It is furthermore noted that the ballast 1 in accordance with the present invention may also be used for operating suspended lighting fixtures for fluorescent lamps or other means, such as decorative ornaments, in which fluorescent lamps are used.

The embodiment shown in Figure 6 finally is an embodiment suitable for use in a ceiling system having visible sections. Also another embodiment can be used in a ceiling system wherein the profiles are not visible.

In that case the edge (3, Figure 5) will be adapted and the bottom plate 2 will be provided with for example an ornamental plate having an aesthetic shape, which plate will be removable in order to secure the housing 1 to the sections 12, possibly through supports accommodated in slotted holes.

Claims

1. A device for operating several fluorescent lamps located outside said device, comprising a housing accommodating at least part of the apparatus required for igniting and letting burn fluorescent lamps coupled to said device by means of high frequency lines, said device being arranged for

coupling, by means of an electric feeder cable, the apparatus inside the housing to an electric power source outside the device.

2. A device according to claim 1, characterized in that the apparatus accommodated in said housing comprises electromagnetic ballast apparatus and starters.

3. A device according to claim 1 or 2, characterized in that in the housing there is furthermore provided further apparatus coupled to said apparatus, which is necessary for igniting and/or letting burn fluorescent lamps coupled to said device.

4. A device according to claim 3, characterized in that said further apparatus comprises compensating and/or anti-interference capacitors.

5. A device according to claims 2 - 4, characterized in that said housing is made of a material which is insensitive to the magnetic leakage field of said electromagnetic ballast apparatus.¹

6. A device according to claim 1, characterized in that said apparatus accommodated in said housing comprises electronic ballast apparatus.

7. A device according to any one of the preceding claims, characterized in that said device is arranged for coupling, by means of an electric switching cable, apparatus accommodated in the housing to a switching installation outside the device.

8. A device according to any one of the preceding claims, characterized in that said housing is provided with an externally accessible connecting means connected to the apparatus inside the housing, which is to be coupled to an electric feeder cable provided with a complementary connecting means.

9. A device according to any one of the preceding claims, characterized in that said housing is provided with an externally accessible connecting means connected to the apparatus inside the housing, which is to be coupled to respective high frequency lines each provided with a complementary connecting means.

10. A device according to claim 7, characterized in that said housing is provided with an externally accessible connecting means connected to the apparatus inside the housing, which is to be coupled to an electric switching cable provided with a complementary connecting means.

11. A device according to any one of the preceding claims, characterized in that inside the housing there is provided an emergency supply device coupled to the apparatus accommodated inside the housing.

12. A device according to any one of the preceding claims, characterized in that a sensor is mounted on the housing, said sensor controlling the operation of the apparatus inside the housing.

13. A device according to any one of the preceding

claims, characterized in that said housing is provided with vent holes.

14. A device according to any one of the preceding claims, characterized in that said housing is portable.

15. A device according to any one of the preceding claims, characterized in that said housing has been adapted to the size of a prefabricated ceiling tile, one side of said housing having an aesthetic finish.

16. Lighting fixture comprising a housing which is internally provided with one or more lamp holders for one or more fluorescent lamps, characterized in that said housing is furthermore provided with means connected to the lamp holder(s), which make it possible to connect said lamp holder(s) to a device according to any one of the claims 1 - 15 by means of one or more high frequency lines.

17. Lighting fixture according to claim 16, characterized in that said means comprise one or more externally accessible connecting means connected to one or more of said lamp holders, which are to be coupled to a respective high frequency line each provided with a complementary connecting means.

18. Ballast for fluorescent lamps, characterized in that said ballast comprises ballast apparatus for one or more external fluorescent lamps.

19. Lighting fixture for fluorescent lamps, characterized in that said fixture does not comprise any ballast apparatus.

20. Lighting fixture for fluorescent lamps according to claim 19, characterized in that said fixture comprises one or more high frequency terminals.

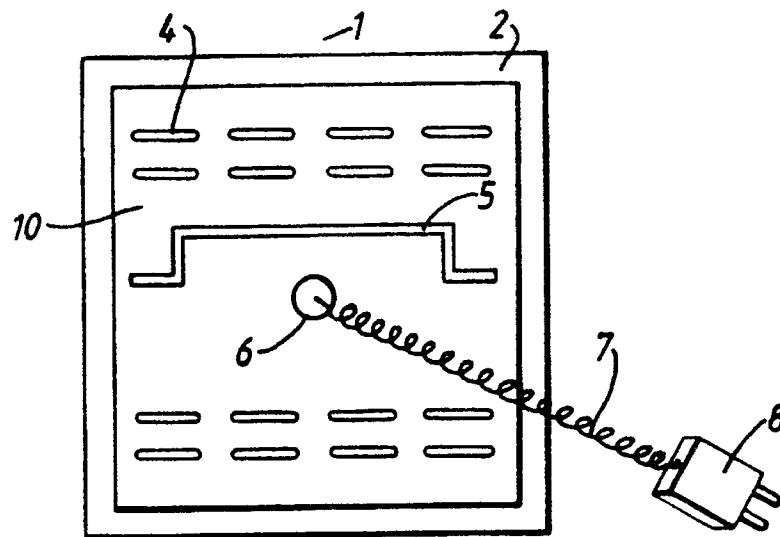


Fig.1.

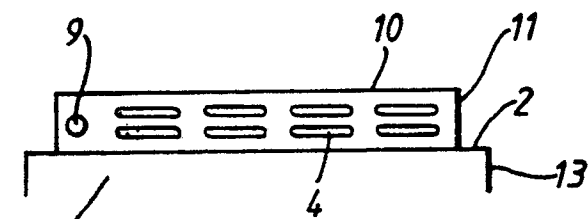


Fig.2.

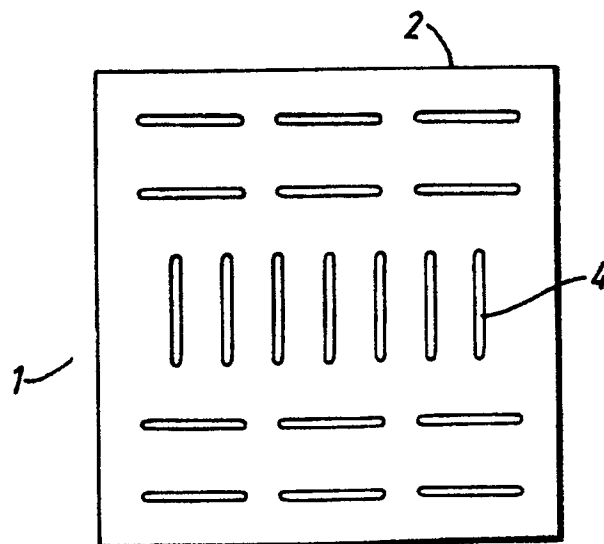


Fig.3.

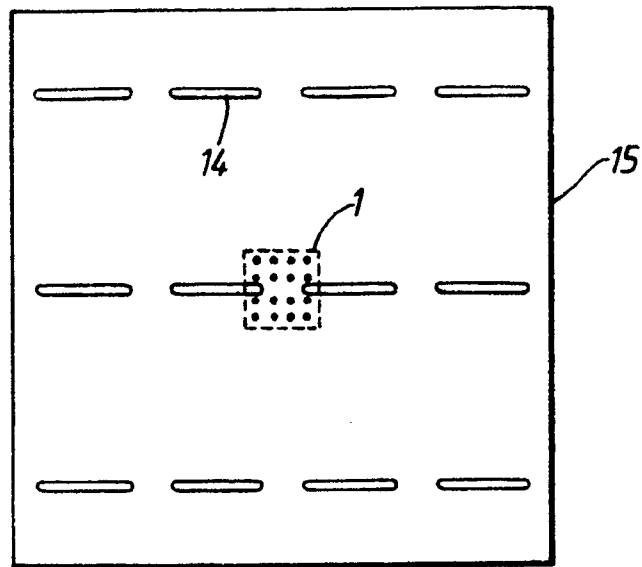


Fig. 4.

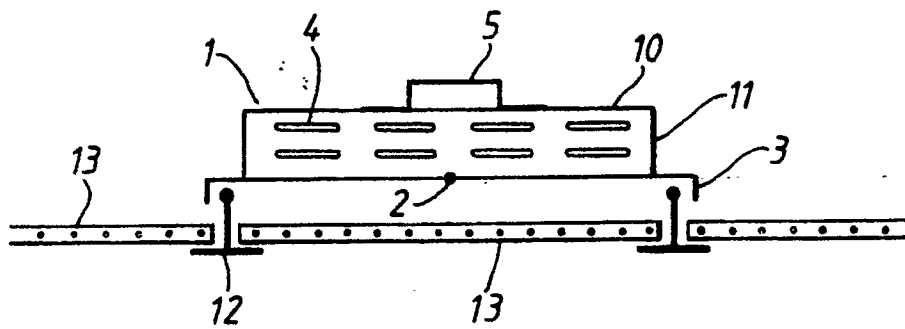


Fig. 5.

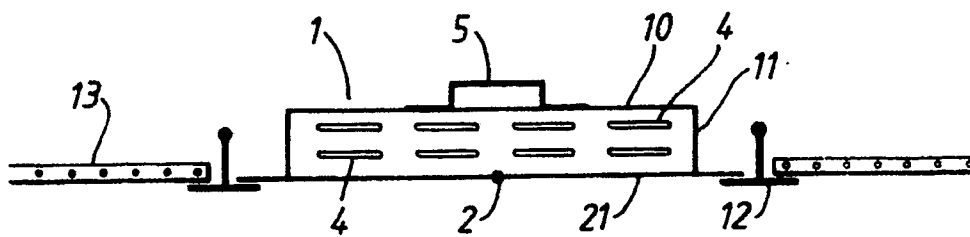


Fig. 6.



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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2940

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 667 133 (NILSSEN) * the whole document * -- -- --	1,3,4,6,7, 9,15, 16-20	H 05 B 41/24 H 05 B 41/00 F 21 V 23/02
X	US-A-4 855 646 (PECKITT) * the whole document * -- -- --	1,3,4,6,7, 9,12-14	
X	EP-A-0 108 815 (STOLZENBERG) * abstract; figure 1 * -- -- -- --	1,5,11	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H 05 B F 21 V
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 12 February 91	Examiner SPEISER P.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ----- &: member of the same patent family, corresponding document			