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(54) **Laundry dryer with a lint filter monitoring device.**

(57) A laundry dryer having a perforated drying drum, an electric blower, at least one electric heater element, an arrangement of air ducts for circulating heated air through said drum for drying the laundry contained therein, and a lint retaining filter disposed in an air duct is provided with a monitoring device for detecting the operative condition, i.e. the state of clogging of said filter. The monitoring device includes at least two sensor electrodes disposed in spaced relationship on or adjacent said filter so as to be short-circuited by moist lint accumulating thereon. The Sensor electrodes are connected to signalling means and/or to an electric circuit controlling operation of the electrical components of the dryer, so as to indicate clogging of the filter through said signalling means and/or to deenergize the electrical components in a clogged condition of the filter.

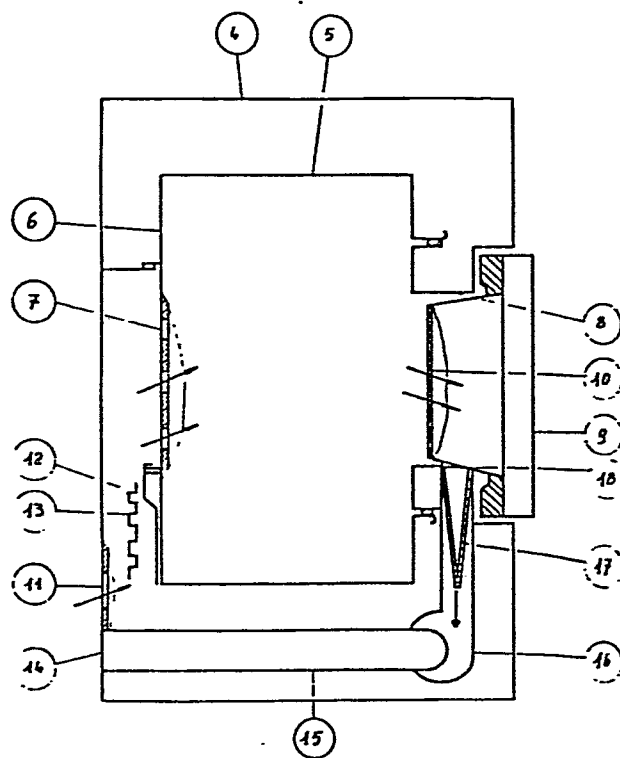


FIG. 1

1 Laundry Dryer with a Lint Filter
 Monitoring Device

5 D e s c r i p t i o n

The present invention relates to a laundry dryer having a filter inserted in a duct for the circulation of heated drying air, and a monitoring device for detecting the operative condition of said filter.

Conventional laundry dryers comprise a blower and heater elements for circulating heated air through the interior of a drum containing the laundry to be dried by way of an air duct.

Inserted in said air duct is a filter adapted to retain lint and possibly present foreign bodies. Such filter is provided with monitoring means connected to the heater elements and to electric motors driving said blower and said drum by means of an electric circuit adapted to switch between two operative conditions. In the first such condition, with the filter functioning properly, this circuit supplies all the electric components of the machine in a regular manner. In the second such condition, with the filter clogged, the speed of the circulating heated air is reduced, and the temperature interiorly of the drum is increased, with the risk of the laundry being singed or burnt.

There have already been proposed various types of filter monitoring devices for detecting the latter operative condition and for interrupting the current supply to the electric components of the machine. A first type of such monitoring device is formed by a temperature sensor adapted to detect an excessive rise of the air temperature within the machine or an overheating condition of the heater elements.

1 A monitoring device of a second type comprises a pneumatic sensor adapted to detect the pressure difference of the heated air between the upstream and the downstream side of the filter.

5

A further monitoring device comprises a mechanical sensor responsive to variations of the air flow rate downstream of the filter.

10 The described monitoring devices thus carry out indirect measurements of the operative condition of the filter in a laundry dryer, so that, in case of failure of other functional components of the dryer, they are apt to erroneously indicate malfunction of the filter, and are thus not fully
15 reliable for the stated purpose.

Also known are monitoring devices directly cooperating with the filter, such devices comprising for instance an optical sensor for detecting the translucency, and thus the degree
20 of clogging, of the filter. Also in this case, however, the obtained measurements of indicative of the operative condition of the filter may be erroneous due to the accumulation of dust on the optical sensor or to drifting of the sensor's adjustment, so that these devices are likewise
25 unsuitable for obtaining satisfactory and reliable results.

It is finally to be noted that all of the described monitoring devices are of intricate construction and require periodic adjustment.

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It is therefore an object of the present invention to provide a filter monitoring device of simple construction, which is reliable in operation and avoids the necessity of periodic adjustment.

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These and other objects are attained according to the invention in a laundry dryer comprising a blower and at least one heater element for circulating heated air through the

1 interior of a drum containing the laundry to be dried
by way of an air duct including a filter associated with a
monitoring device connected to said heater element and to
electric motors of said blower and said drum through an
5 electric circuit adapted to switch between two operative
conditions.

In accordance with the invention, a laundry dryer of the
type indicated above is characterized in that said monitor-
10 ing device comprises at least two sensor electrodes disposed
in spaced relationship and electrically insulated from one
another adjacent said filter for measuring the electric
conductivity of lint progressively accumulating on the
active filter surface.

15 Further characteristics and advantages of the invention
will become evident from the following description of
exemplary embodiments thereof, with reference to the
accompanying drawings, wherein:

- 20 fig. 1 shows a diagrammatic cross-sectional view of a
laundry dryer according to the invention,
fig. 2 shows a perspective view of a filter for mounting in
the laundry dryer of fig. 1, in a first embodiment
of the invention, and
- 25 fig. 3 shows a perspective view of a filter constructed in
accordance with a second embodiment of the invention.

With reference to fig. 1, a laundry dryer according to
the invention comprises a housing 4 enclosing a perfor-
30 ated drum 5 for containing the laundry to be dried, mounted
for rotation about its horizontal axis under the action of
an electric motor (not shown). In particular, drum 5 is
provided with a rear portion 6 formed with perforations 7.
The dryer further comprises a front opening 8 closed by a
35 door 9 giving access to drum 5 and being provided with a
perforated interior wall 10. The rear side of the dryer is
formed with openings 11 for the aspiration of air which is
conveyed to the interior of drum 5 by way of an inlet duct

1 12 connected to rear portion 6 of drum 5 and enclosing at
least one electric heater element 13. From drum 5 the heated
air is exhausted through perforated wall 10 and conveyed
to an outlet opening 14 by way of a further air duct 15
5 having a motor-driven blower installed therein.

In addition, duct 15 is provided with at least one filter
17 inserted therein through inlet opening 18 and serving
to retain any lint set free by the laundry and any foreign
10 matter possibly carried along in the air stream, and with
a device for monitoring the operative condition of filter 17.

As diagrammatically shown in fig. 2, filter 17 in a first
embodiment of the invention comprises two complementary
15 frames 19 and 20 formed of a suitable insulating material
and enclosing each a metallic filtering surface 21, 22 of
a fine mesh structure. Frames 19 and 20 are hingedly con-
nected to one another along adjacent edges 23, 24, so that
the filter can be opened in the manner of a book for
20 cleaning and lint removal.

The opposite free edge portions 27, 28 of frames 19, 20
are formed with mutually engageable means 25, 26 for
retaining the two frames in a partially closed position,
25 in which they form an acute angle between themselves, so
as to maintain a certain distance between filtering surfaces
21, 22. In this embodiment, the above named monitoring
device is formed by the two filtering surfaces 21, 22 of
the filter 17 itself, which to this effect additionally
30 perform the function of sensor electrodes for detecting
the degree of clogging of the filter in a manner to be
described. The thus formed sensor electrodes are elect-
rically insulated from one another by the respective frames
19, 20, and connected to the electric circuit of the dryer
35 including heater element 13 and the electric motors driving
drum 5 and blower 16.

The monitoring device of this embodiment basically functions

1 through measurement of the varying electric conductivity
of the lint accumulating between the filtering surfaces of
the filter during the operation of the dryer, during
which the filter is traversed by a stream of moist air.

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As the accumulating lint is moist, its fibers act as elect-
ric conductors, permitting a weak current to flow across
the sensor electrodes. This current may then be measured
by means of a conventional electronic device connected to
10 the sensor electrodes and to optical or acoustical signal
means of any known type.

The described monitoring device is adjusted so as to remain
inactive as long as the lint progressively accumulating on
15 the filter allows a sufficient flow of heated air to pass
therethrough for ensuring satisfactory drying of the laundry
at temperatures lying between predetermined limits.

Under these conditions the signalling means is not activ-
20 ated, while electric heating element 13 and the above
described motors continue to be supplied with current from
the program unit of the machine (not shown).

Only when the filter becomes substantially clogged with lint,
25 so that the speed of the air flow passing through the
filter is decreased and the laundry within the drum is
being dried at excessive temperatures with the danger of
the laundry being damaged thereby, the monitoring device
is activated in the described manner.

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Under this condition the signal means is automatically
activated to indicate to the user that the filter is com-
pletely clogged, while the heater element 13 and the motors
are deenergized so as to interrupt the operating cycle of
35 the dryer and to avoid any damage to the laundry.

Filter 17 may then be extracted from the dryer, thoroughly
cleaned of the lint adhering thereto, and returned to its

1 position for completing the interrupted drying cycle.

In the modified embodiment of the invention shown in
fig. 3, the filter comprises a single frame 29 formed of
5 a suitable insulating material and enclosing a fine-mesh
filtering surface 30.

In this embodiment the sensor electrodes are formed as
metallic rods 31, 32 transversely affixed to filtering
10 surface 30 in spaced positions and, if the filter surface
30 is formed of metal or another electrically conductive
material, with the interposition of insulating supports 33
and 34, respectively.

15 As in the above described first embodiment, the sensor
electrodes are connected to the electric circuit of the
machine so as to indicate the operative condition of the
filter in a similar manner. Within the scope of the invent-
ion it is of course possible to design the sensor elect-
20 rodes in any other suitable manner as long as it is ensured
that they can be effectively short-circuited by an accum-
ulation of moist lint so as to be able to measure the
electric conductivity thereof.

25 The described monitoring device is of simple construction,
of convenient use and adapted to directly, accurately and
reliably detect the operative condition of the filter with-
out the necessity of periodic adjustment and of employing
structurally complicated monitoring devices of the types
30 described in the introduction.

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Laundry Dryer with a Lint Filter
Monitoring Device

P a t e n t C l a i m s

1. A laundry dryer comprising a blower and at least one heater element for circulating heated air through the interior of a drum containing laundry to be dried by way of an air duct including a filter associated with a monitoring device connected to said heater element and to electric motors of said blower and said drum through an electric circuit adapted to be switched between to operative conditions, characterized in that said monitoring device comprises at least two sensor electrodes (21, 22) disposed in spaced relationship and electrically insulated from one another adjacent said filter (17) so as to measure the electric conductivity of lint progressively accumulating on the active filter surface.

1 2. A laundry dryer according to claim 1, characterized
in that each said sensor electrode is formed by a metallic
filtering surface portion (21, 22) of said filter (17)
enclosed in a frame (19, 20) of an insulating material,
5 said frames (19, 20) being hingedly connected to one an-
other along adjacent edges and provided with mutually
engageable means (25, 26) adjacent their free edges (27, 28).

3. A laundry dryer according to claim 1, characterized
10 in that said sensor electrodes are formed as metallic
rods (31, 32) affixed in spaced relationship to only one
filtering surface (30) of said filter with the possible
interposition of respective insulating supports (33, 34).

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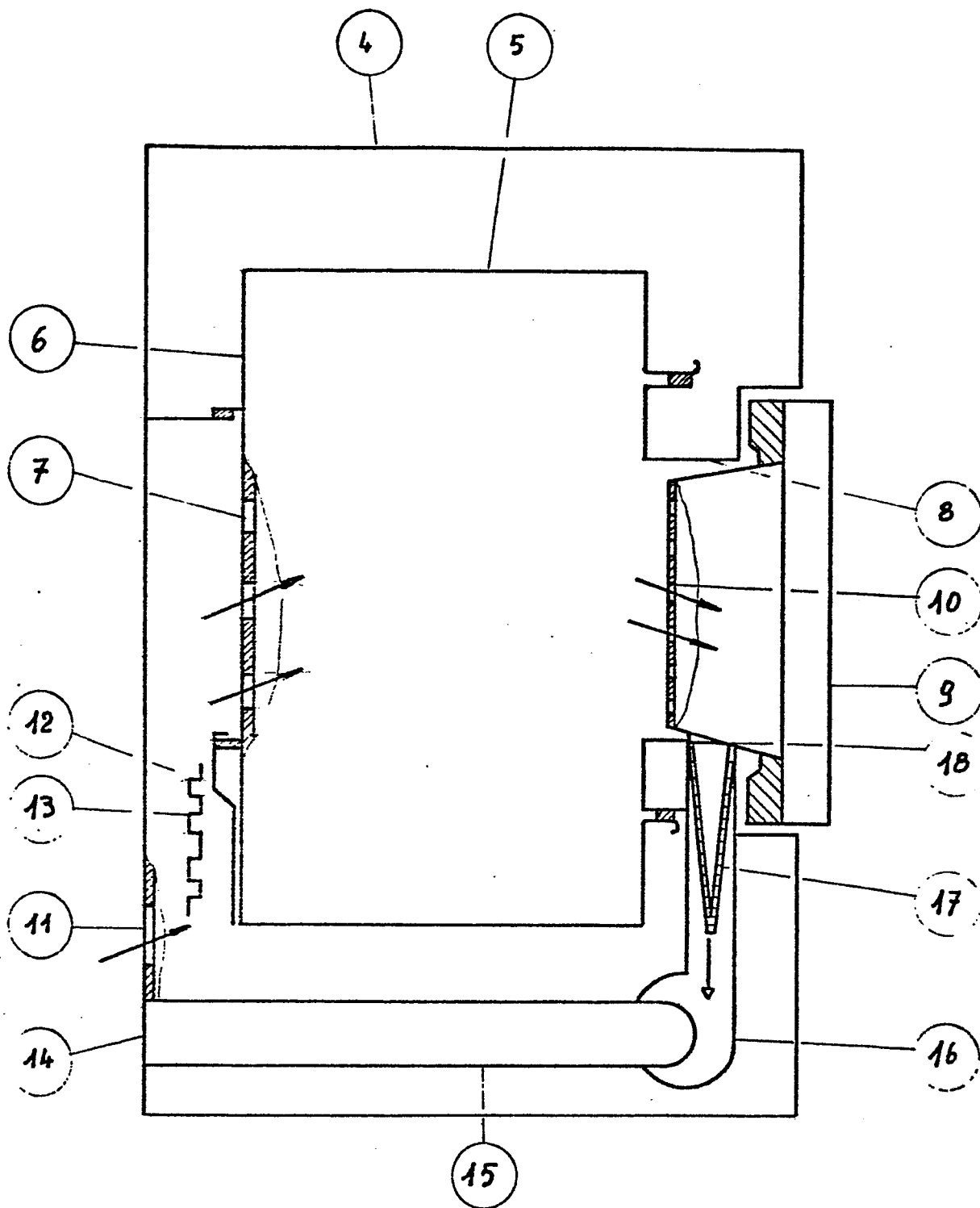


FIG. 1

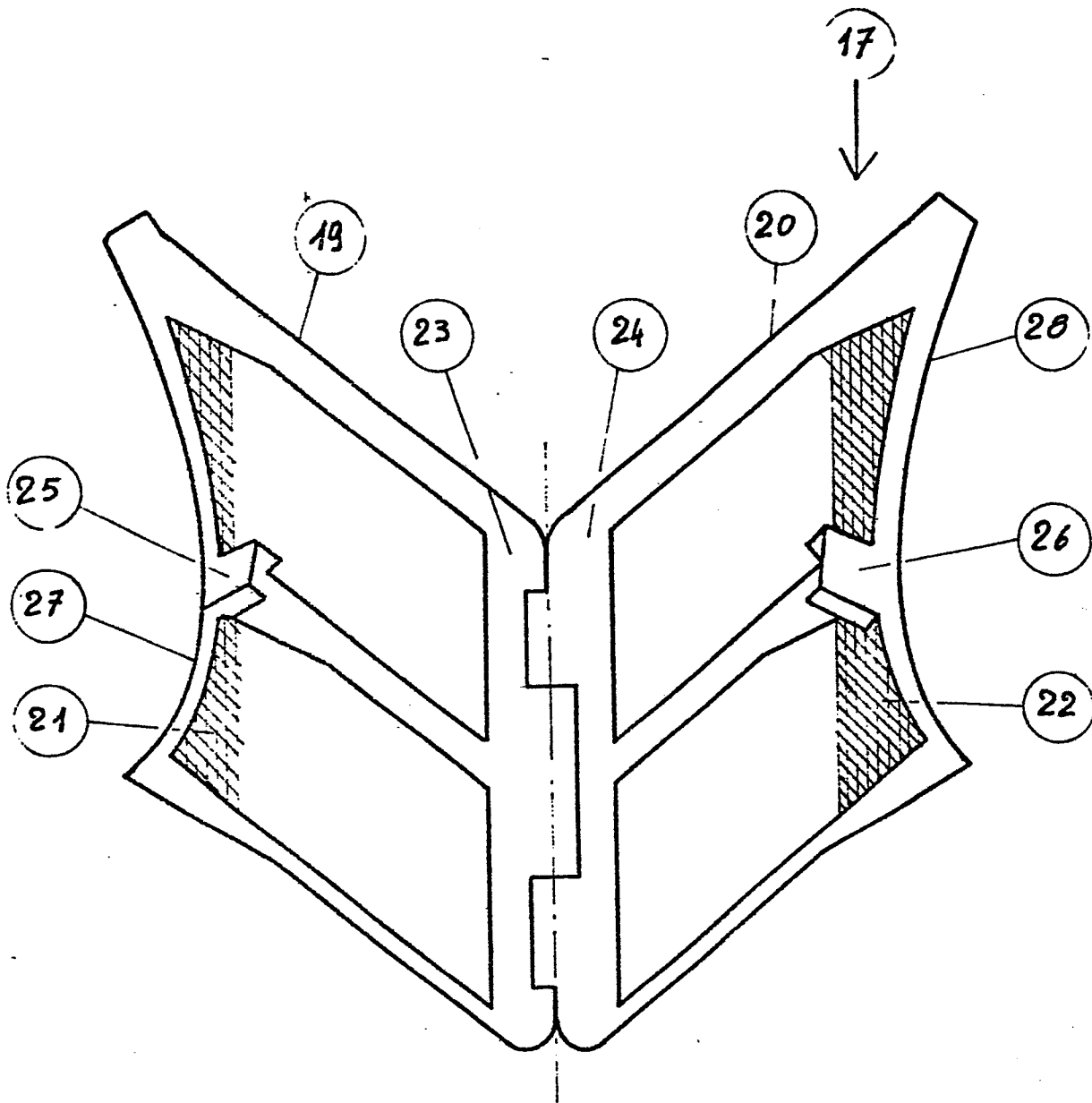


FIG. 2

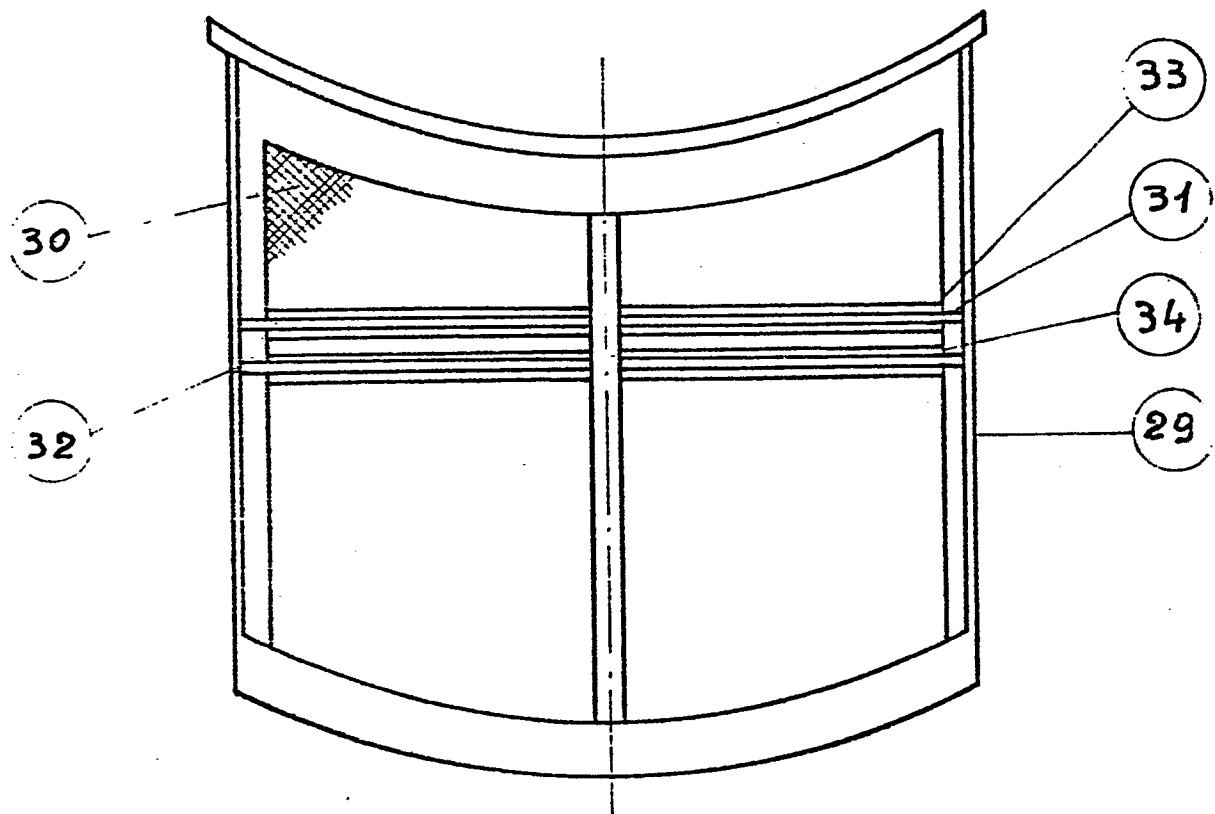


FIG. 3