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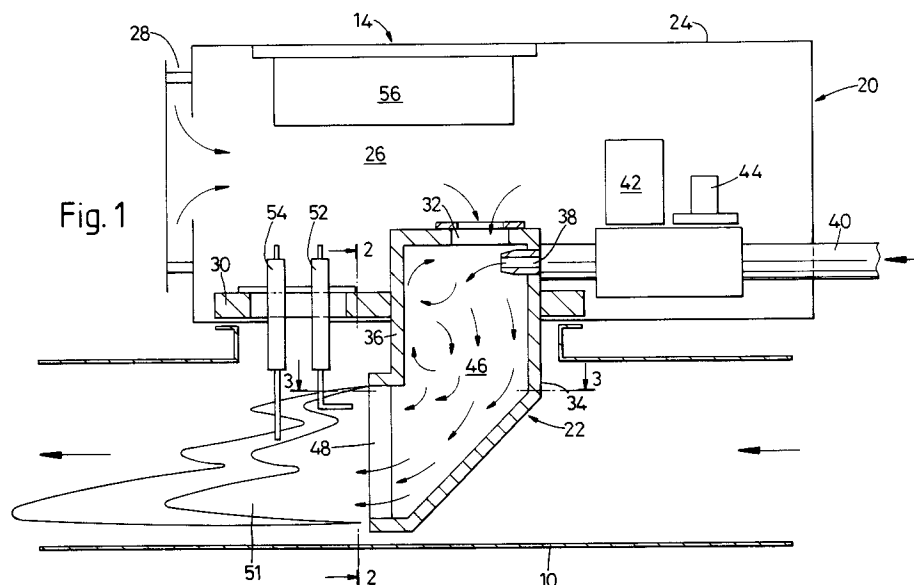
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**AT BE CH DE DK ES FR GR IE IT LI LU NL PT
SE**(71) Applicant: **AMBI-RAD LIMITED**
P.O. Box No. 30
Enfield Works
Mucklow Hill
Halesowen West Midlands B62 8DS(GB)(72) Inventor: **Dunne, Simon**
52 Beech Road
Bourneville, Birmingham B30 1LJ(GB)
Inventor: **Arnold, John**
20 The Orchard
North Holmwood
Dorking, Surrey RH5 4JT(GB)(74) Representative: **Spruce, George Philip et al**
Shaw, Bowker & Folkes
Whitehall Chambers
23 Colmore Row
Birmingham B3 2BL (GB)(54) **Space heating appliances.**

(57) Radiant tube space heating appliance has one or more burner assemblies (14) comprising a fuel/air infeed and control unit (20) mounted externally of the tube (10) with a burner head (22) projecting into the tube. Said head defines a fuel mix passage (46) leading to a burner mouth (48) facing downstream

and shaped as an elongated slot with its major dimension along the direction of the projection of the head in the duct so that the overall width of the head is minimized to reduce obstruction to gas flow along the duct.

**EP 0 606 782 A1**

This invention relates to radiant tube space heating appliances of the kind comprising a radiation tube or duct, commonly suspended overhead in the space to be heated, a fan or other pump for inducing flow of gases along the duct in use, and one or more fluid fuelled burner assemblies, typically gas fired and automatically controlled, for feeding hot gases into said flow. Radiant heat is emitted from the duct surface and this is commonly directed and concentrated, e.g. in a downward direction, by reflectors mounted adjacent to the duct. Said appliances are hereinafter referred to as "radiant tube heating appliances".

Examples of known constructions of radiant tube heating appliance are described in EP 0 248 629-A and in EP 2 102 555-A.

The object of the invention is to provide a radiant tube heating appliance which is reliable and efficient in operation, and which gives improved performance and output.

According to the invention there is provided a radiant tube heating appliance as hereinbefore defined including a burner assembly comprising a burner head extending from a control and fuel mixing unit of the assembly to project laterally inwardly of the radiation duct into the path of flow therethrough in use and defining a fuel mix passage leading to a burner mouth defined by a front wall of the head angled to face downstream of said path of flow whereby the mix is operatively discharged along said flow for combustion in the duct immediately downstream of the head; characterised in that the burner mouth is an elongated slot whose major dimension extends longitudinally of the head in its direction of projection into the duct and whose minor dimension lies widthwise of the head viewed in a plane normal to the axis of the flow path and with the overall width of the head within the duct being little greater than the width of said mouth so that obstruction to flow in the duct past the head is minimized.

This arrangement has the effect of concentrating the flow of mix issuing from the mouth in use towards the distal end of the slot remote from the mixing unit so that more combustion takes place adjacent to a circumferential zone of the duct wall at the side opposite to said mixing unit to increase radiant heat output from that zone which will be operatively mounted to face e.g. downwardly or otherwise towards the parts of the space where most heat is required.

Conveniently said burner mouth will include a honeycomb or other matrix, e.g. formed from corrugated or other strip stainless steel or other metal, to prevent burning back into the head and smooth and further direct the outflow of mix therefrom.

It is preferred that the mixing unit includes connections for feeding gas fuel and combustion

air to the fuel mix passage of the head which are positioned at or towards the rear and upstream facing wall thereof so that the inflows into the head for mixing therein are further concentrated in the direction of said distal end of the slot.

Typically the proportions of the slot forming the burner mouth will have a major dimension: minor dimension ratio of at least 2.8:1.

It is to be understood that the heating appliance may include a plurality of said burner assemblies spaced at intervals along a common radiation duct. Said assemblies may be disposed in series along a single duct length or may act in parallel in limbs of a branched duct and they may all be controlled in common or may have a degree of independent control dependent on requirements for the particular installation.

An example of the invention is now more particularly described with reference to the accompanying drawings, wherein:

Figure 1 is a sectional side view of part of a heating appliance showing a burner assembly,

Figure 2 is a sectional elevation on line 2-2 of Figure 1;

Figure 3 is a sectional view on line 3-3 of Figure 1, and

Figure 4 is a diagrammatic perspective underneath view of overhead installation of a space heating appliance incorporating several said burner assemblies.

The radiant tube space heating appliance of this example is an installation for heating a large space such as a factory building or public hall; the overall installation is generally conventional comprising branched runs of radiation duct being circular section tube 10 mounted overhead, e.g. near roof or ceiling level and provided with reflectors 12 for directing and concentrating the emitted radiant heat downwards in known manner. Hot gases provided by burner assemblies 14 at spaced intervals along each branch are drawn through the tube 10 by a common exhaust fan 16 leading to a discharge flue 18. Fan 16 is automatically controlled in known manner to maintain negative pressure in the system of tube 10 i.e. a degree of depression below the ambient atmosphere pressure and the gas flow in the various branches may be further regulated and balanced by manual or automatic dampers (not shown) in known manner.

One of the burner assemblies 14 will now be described in greater detail with reference to Figures 1-3. It comprises a fuel/air infeed and control unit 20 mounted externally on the upper periphery of tube 10 and a burner head 22 which projects downwardly into the tube as described in greater detail below.

Unit 20 includes a box 24 defining an air chamber 26 which also serves as a protective enclosure

for components of the unit, air being drawn into box 24 through a baffled air inlet 28 at one end. An air filter may also be provided.

The upper end part of burner head 22 projects through a mounting plate 30 forming part of the floor of box 24 and which is secured to a flanged opening in the top of tube 10. The top of head 22 defines an air infeed opening 32 communicating directly with chamber 26 and which is off-centre, being positioned nearer to the rear wall 34 of head 22 than to its front wall 36 so that the air inflow is concentrated towards said rear wall. A gas fuel nozzle 38 also opens into the upper part of head 22 through the top of rear wall 34 and is connected to a gas fuel feed pipe 40 through a safety cut-off valve 42 and a gas pressure governor 44.

The hollow interior of burner head 22 constitutes a fuel mix passage 46, the air and gas fuel inputs being proportioned so that a combustible mix is produced.

The lower part of head 22 within tube 10 projects into the path of flow of gases induced along tube 10 from right to left as viewed in Figure 1 and the lower part of front wall 36 defines a rectangular burner mouth 48 on a diametral plane of tube 10 and angled to face downstream of the path of flow along tube 10.

Mouth 48 is in the form of an elongated slot as best seen in the elevation of Figure 2, its height, i.e. extent lengthwise of front wall 36 being considerably greater than its width. Mouth 48 is centered in tube 10, and in this example its height is around two thirds of the tube diameter. The ratio of height to width of the mouth is preferably at least 2.8:1.

In order to minimize obstruction of throughflow along tube 10 the overall width of head 22 is only slightly greater than the width of mouth 48 but the depth between the front wall 36 and rear wall 34 is substantially greater. To provide streamlining rear wall 34 has only a short vertical section depending from plate 30 and is then angled to slope downwards at about 45 degrees towards the bottom of mouth 48. Said rear wall is also V shaped in horizontal section as shown in Figure 3 so that its exterior faces form an acute angle pointing upstream of the throughflow.

The gas mix flowing down burner head passage 46, already somewhat concentrated towards rear wall 34 by reason of the offsetting of air infeed opening 32 will be further concentrated downwardly as it flows along the angled section of said rear wall and changes direction through 90° to issue from the vertical mouth 48, thus the flow velocity issuing from the distal and lower part of mouth 48 will be greater than that issuing from the upper part. Sustained combustion of the outflow of mix takes place in tube 10 immediately downstream of matrix 50, the latter serving to smooth and assist

flame retention and also prevent any tendency to burn back into the mix passage 46. Due to the above flow distribution of the mix leaving head 22 the resultant flame will be concentrated in a lower zone of tube 10 as indicated diagrammatically at 51 in Figure 1 so that the maximum heating effect is applied to a lowermost zone of the peripheral wall of the tube. This substantially assists in concentrating the output of radiant heat in a downward direction towards the space where it is most wanted, so improving efficiency and performance. The downward direction and concentration of the radiant heat will be supplemented by the action of the reflectors 12.

Plate 30 also mounts a conventional electrical ignition device 52 for initiating combustion of the mix on start-up and a conventional flame sensing electrode 54 acting in conjunction with cut-off valve 42 to terminate the gas fuel supply in case of flame failure, these controls being associated with an electrical module 56 of the burner assembly in known manner.

Typically the burner head will operate at a negative pressure of at least 2 mba within its mix passage 46 and all the air required for combustion of the gas fuel is pre-mixed in said passage prior to discharge from mouth 48. The use of the honeycomb matrix 50 in the mouth also provides improvements in efficiency and performance in comparison with the multi-port ceramic burner mouth inserts used in some known appliances.

Further improved efficiency and performance is also provided by the shaping of the burner head to reduce resistance to throughflow along the radiant tube 10. The consequent reduction in pressure drop enables a greater number of burner assemblies to be operated in a given run of tubes for increased output if required; and/or a greater heated area to be served on a common tube installation run by a single fan or pump and discharge flue; and/or the use of a smaller capacity pump or fan for a given capacity of installation so that the system runs more quietly and less sound insulation is required.

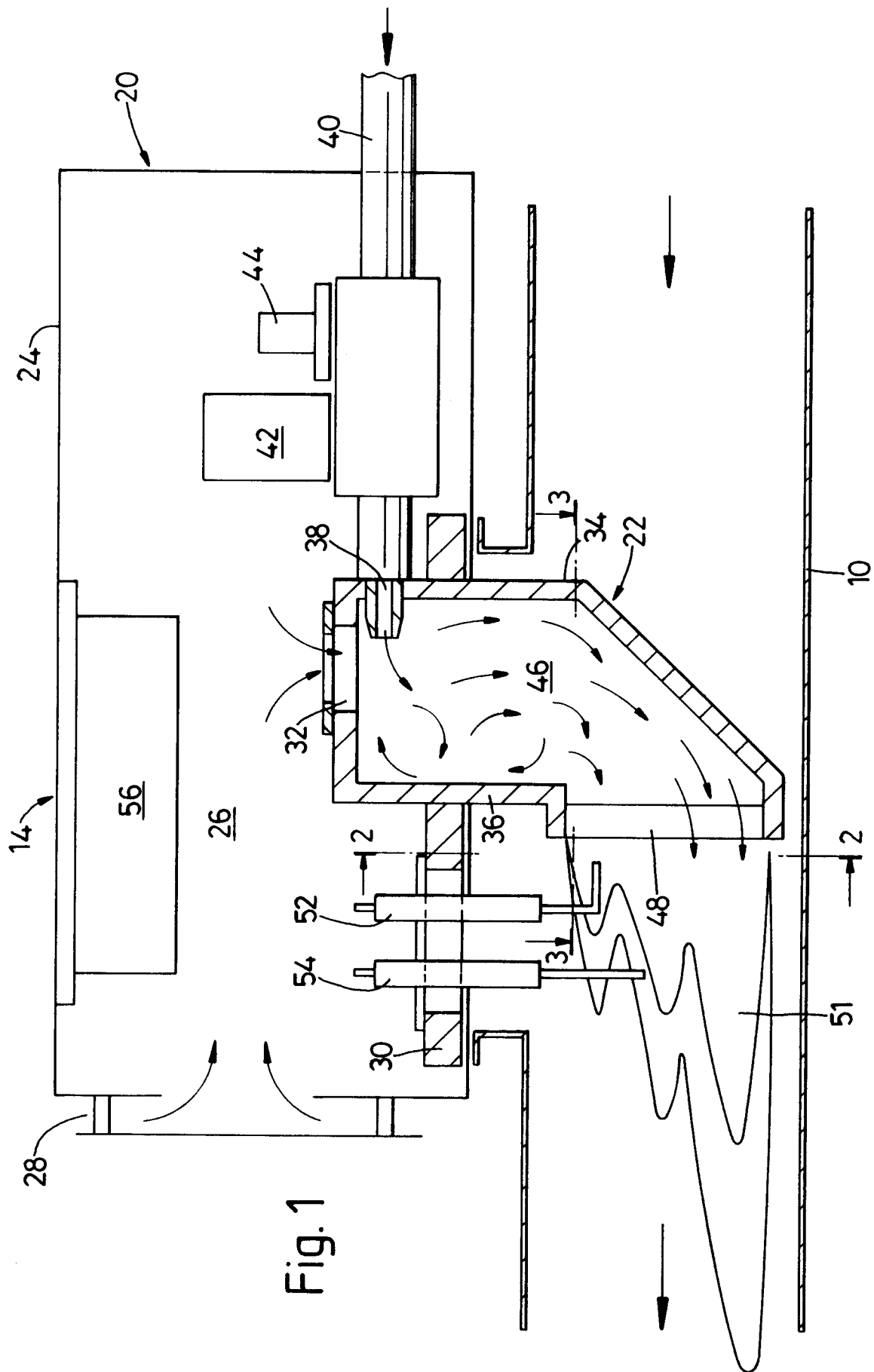
Claims

1. A radiant tube heating appliance as hereinbefore defined including a burner assembly (14) comprising a burner head (22) extending from a control and fuel mixing unit (20) of the assembly to project laterally inwardly of the radiation duct (10) into the path of flow therethrough in use and defining a fuel mix passage (46) leading to a burner mouth (48) defined by a front wall (36) of the head angled to face downstream of said path of flow whereby the mix is operatively discharged along said flow

for combustion in the duct immediately downstream of the head; characterised in that the burner mouth is an elongated slot whose major dimension extends longitudinally of the head in its direction of projection into the duct and whose minor dimension lies widthwise of the head viewed in a plane normal to the axis of the flow path and with the overall width of the head within the duct being little greater than the width of said mouth so that obstruction to flow in the duct past the head is minimized.

2. An appliance as in Claim 1 characterized in that the burner mouth (48) includes a honeycomb or other matrix (50) for preventing burning back into the head and for smoothing and directing the outflow of mix therefrom.
3. An appliance as in Claim 2 characterized in that the matrix (50) is formed from corrugated or other strip metal.
4. An appliance as in Claim 1, 2 or 3 characterized in that said slot has a major dimension: minor dimension ratio of at least 2.8:1.
5. An appliance as in any preceding claim characterized in that a major part of the rear wall (34) of the head (22) is angled to converge towards the edge of the burner mouth (48) remote from said unit (20).
6. An appliance as in any preceding claim wherein the rear wall (34) of the head (22) is V-shaped in section so that its exterior faces form an acute angle pointing upstream of said path of flow.
7. An appliance as in any preceding claim characterized in that an air infeed opening (32) of the burner head (22) opens directly from an air chamber (26) of said unit at a position nearer to the rear wall (34) of the head than to its front wall (36) to concentrate air inflow towards said rear wall.
8. An appliance as in any preceding claim wherein the radiation tube or duct (10) is operatively suspended or positioned overhead in the space to be heated, characterized in that the burner assembly (14) is mounted so that the burner head (22) extends downwardly from said unit (20) to project towards the lower part of the duct wall to concentrate radiant heat output from the lower zone of the duct in use.
9. A heating appliance as in any preceding claim characterized in that a plurality of said burner

assemblies (14) are operatively spaced at intervals along a common branched or other radiation tube or duct (10) to act therein in series and/or parallel relationship.



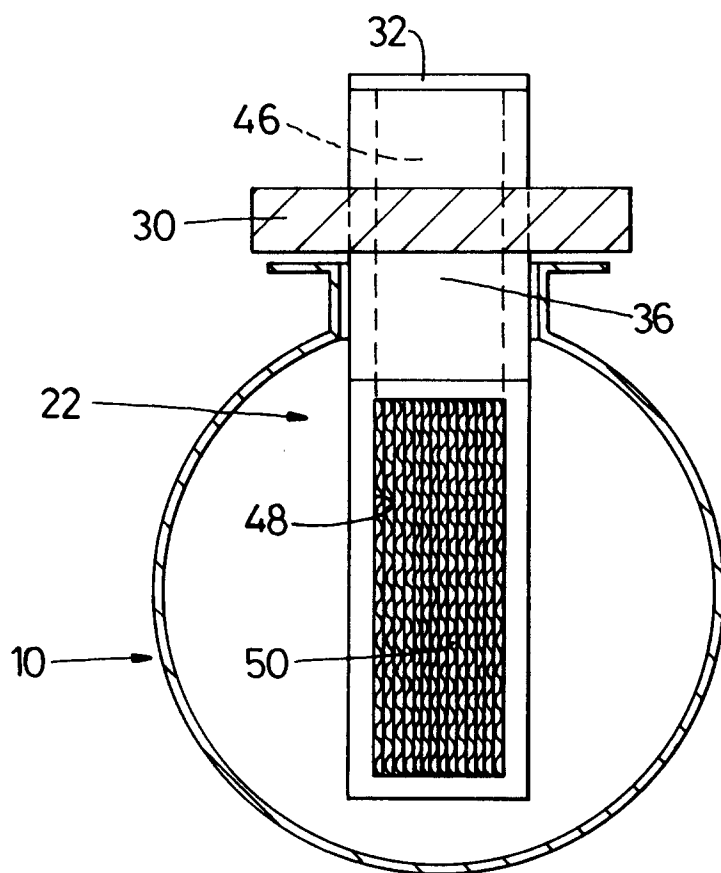


Fig. 2

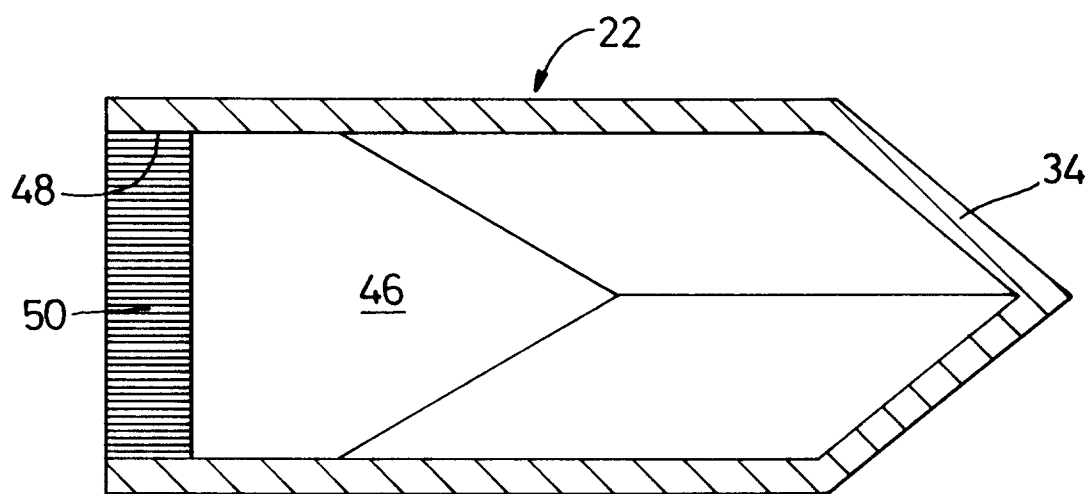


Fig. 3

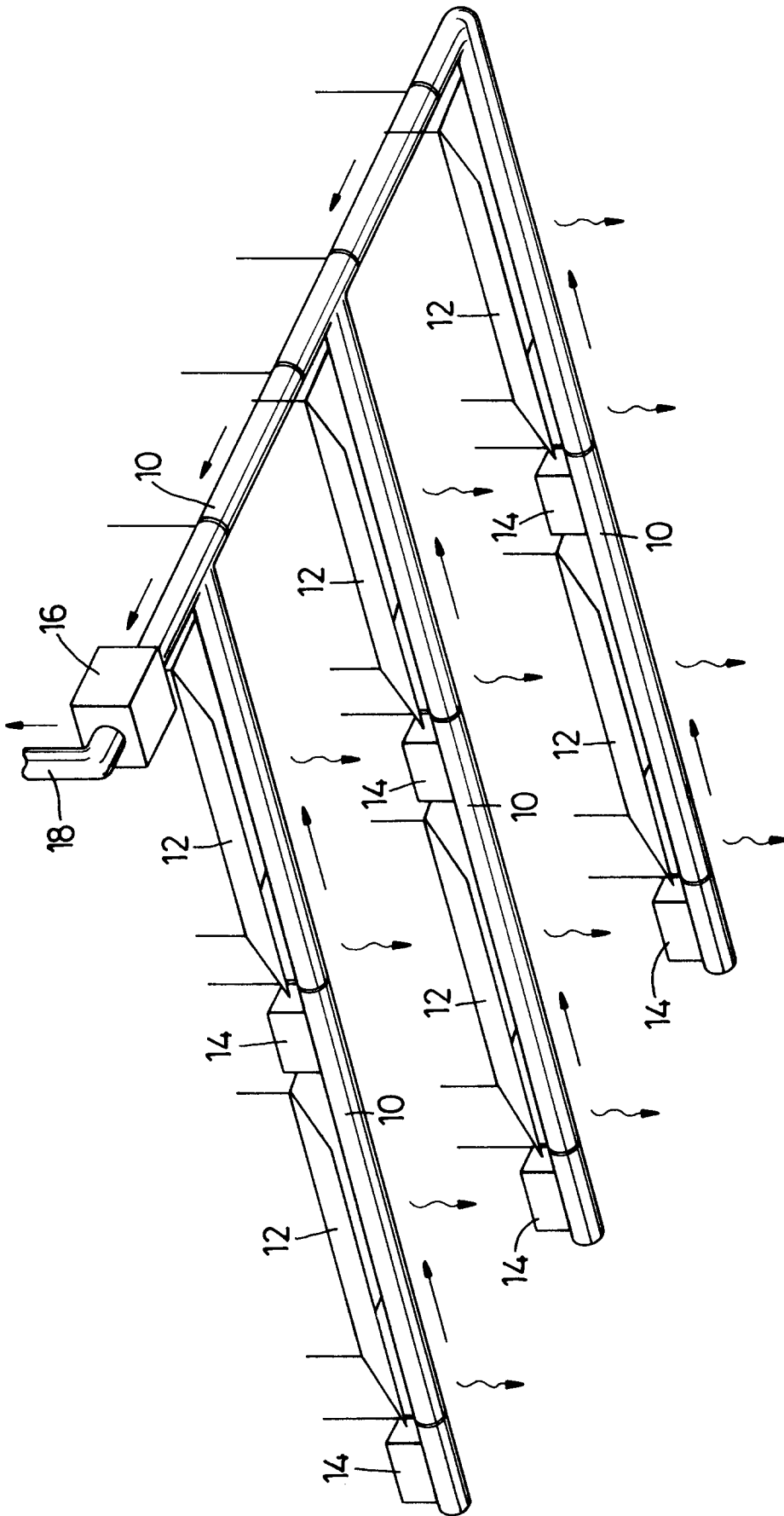


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 93 31 0648

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 Y A	EP-A-0 034 264 (ROBERTS-GORDON APPLIANCE CORP) * page 4, line 25 - page 6, line 27; figures 1,2 * ---	1,5 2,3,8,9 4,7	F23C3/00 F23D14/58 F23D14/62 F24D5/08
D,Y	EP-A-0 248 629 (AMBI-RAD LTD) * column 3, line 57 - column 4, line 23; figures 4-7 * ---	2,3	
Y	EP-A-0 392 591 (HOAF RAY-O-THERM) * column 1, line 46 - column 2, line 27; figure * -----	8,9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.5) F23C F23D F24D
Place of search THE HAGUE		Date of completion of the search 19 April 1994	Examiner Vrugt, S
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			