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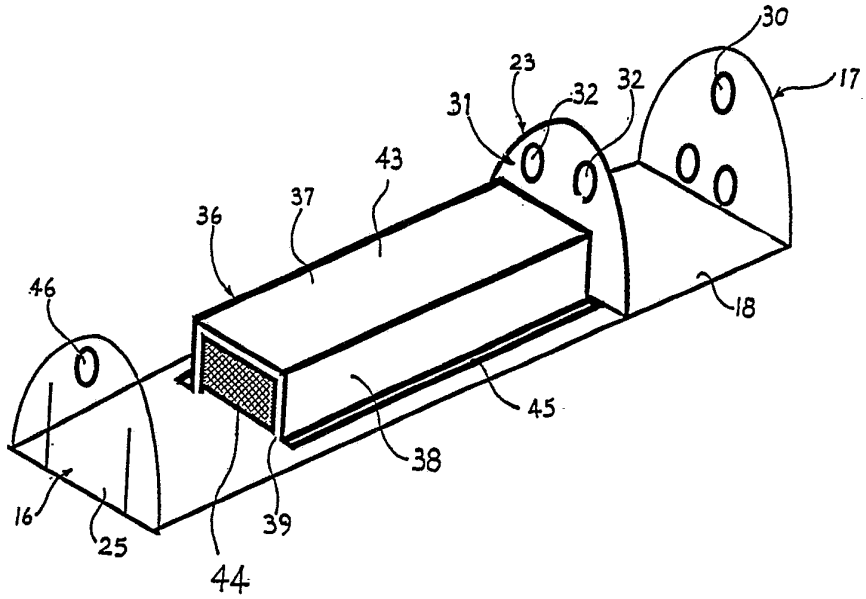
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(54) Title: PROCESSING APPARATUS



(57) Abstract

Apparatus for use in processing a substance with a gaseous fluid. The apparatus comprises a processing chamber (22) for receiving a charge (44) of the substance for processing. An inlet means (31) is provided for introducing gaseous fluid into the processing chamber. An outlet means (34) is provided for removing gaseous fluid from the processing chamber. A tunnel (36) defines a fluid flow passage in the chamber, the fluid flow passage having an entry end (39) communicating with the processing chamber and an exit end (40) communicating with the outlet means. The tunnel (36) has walls which are flexible to generally conform to the profile of the charge (44) which is positioned within the tunnel. The walls of the tunnel deflect under the influence of fluid pressure in the processing chamber to sealingly contact the charge of substance in the tunnel. This ensures that gaseous fluid flowing through the tunnel passes through the charge within the tunnel.

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"PROCESSING APPARATUS"

TECHNICAL FIELD

THIS INVENTION relates to apparatus for use in processing a substance with a gaseous fluid.

The invention has been devised particularly, although not solely, for use as a kiln for processing timber with heated air for the purpose of removing moisture from it.

SUMMARY OF INVENTION

In one form the invention resides in apparatus for use in processing a substance with a gaseous fluid comprising a processing chamber for receiving a charge of said substance for processing, an inlet means for introducing gaseous fluid into the processing chamber, an outlet means for removing gaseous fluid from the processing chamber, means defining a fluid flow passage in the chamber, the fluid flow passage having an entry end communicating with said processing chamber and an exit end communicating with said outlet means, the fluid flow passage having a side wall means which is flexible to generally conform to the profile of a charge of said substance positioned in said flow passage for processing.

With this arrangement, said side wall means is in sealing contact with the charge of substance in the passageway, and thus gaseous fluid is caused to pass through the charge of substance thereby ensuring proper processing of the substance.

Preferably, said side wall means deflect under the influence of fluid pressure in the processing chamber thereby to sealingly contact the charge of substance in said fluid flow passage.

Where the gaseous fluid is to be heated for processing of said substance, the processing chamber is preferably defined between wall means at least part of which is at least partially transparent to heat from solar radiation to facilitate heating of the gaseous fluid.

Preferably, said means defining the fluid flow passage includes a sheet of flexible material which provides a blanket covering for the charge of substance. Preferably, the flexible sheet has longitudinal marginal portions parallel to the direction of fluid flow through said flow passage and said longitudinal marginal portions are in use located in sealing contact with a wall of the processing chamber, said wall preferably being the floor of the processing chamber.

Preferably, the flexible sheet is impervious to the gaseous fluid.

Preferably, said outlet means comprises an opening in a wall of the processing chamber and said exit end of the fluid flow passage surrounds said opening.

Preferably, said inlet means includes an opening in the wall of the processing chamber which also contains said outlet opening.

Preferably, said inlet means includes a fan or other delivery means for delivery gaseous fluid into the processing chamber through said inlet opening.

Preferably, said apparatus further includes a mixing chamber communicating with said inlet and outlet openings

whereby fluid recirculating through the processing chamber passes through the mixing chamber.

Preferably, a damper means is provided to regulate fluid flow through the mixing chamber between said outlet and inlet openings.

Conveniently, the processing chamber is defined within an enclosure which comprises a frame structure and a covering supported by the frame structure.

Preferably, the covering comprises spaced inner and outer walls. The inner and outer walls are preferably constructed of flexible material. Preferably, the spacing between the inner and outer walls is adapted to receive air under pressure to reinforce the covering and to enhance the thermal insulation properties of the covering.

In another form the invention resides in a kiln for processing a substance with heated gaseous fluid, the kiln comprising wall means defining a processing chamber, at least part of said wall means being at least partially transparent to heat from solar radiation to facilitate heating of gaseous fluid in the processing chamber.

Means such as a furnace may be provided for providing additional heat to the gaseous fluid.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the following description of one specific embodiment thereof. The embodiment is directed to a kiln for drying or seasoning timber using heated air. The description

will be made by reference to the accompanying drawings in which:-

Fig. 1 is a schematic isometric view of a kiln according to the embodiment with part of the exterior covering cut-away to reveal an internal frame structure;

Fig. 2 is a schematic view of the apparatus of Fig. 1 with the exterior covering and informal frame structure removed to reveal the internal arrangement within the kiln;

Fig. 3 is a schematic plan view of the kiln;

Fig. 4 is a schematic side view of the kiln;

Fig. 5 is a schematic view, on an enlarged scale, showing a stack of timber in a fluid flow passage in the kiln.

DESCRIPTION OF PREFERRED EMBODIMENT

The embodiment shown in the drawings is directed to a kiln for drying or seasoning timber using heated air.

The kiln comprises an enclosure 11 defined by a covering 13 supported on a frame structure 14. The covering is of a construction which is transparent to heat from solar radiation to thereby create a "green-house" effect within the enclosure. The covering 13 includes side wall means 15, two spaced end wall skins 16 and 17 respectively, and a floor 18. The side wall means 15 comprises inner and outer walls 19 and 20 respectively of impervious flexible plastic sheeting separated by an air space 21 which is adapted to receive air under pressure thereby to inflate the covering 13 and improve its stability. The air space also provides a thermal barrier which serves to trap heat within the enclosure.

A processing chamber 22 is defined within the enclosure between end wall 16 and an internal wall 23. Similarly, a mixing chamber 24 is defined within the enclosure between the internal wall 23 and the other end wall 17.

The end wall 16 is provided with an entrance 25 for access to the processing chamber 22. The entrance 25 is in the form of a flap which is integral with the end wall and is provided with suitable fastening means such as zippers which inhibit air leakage from the processing chamber.

The kiln receives heated air from a gas fired furnace (not shown) by way of ducting 26. The ducting 26 includes a delivery duct 27 and a return duct 28 whereby air heated by the furnace can be delivered to the mixing chamber 24 by way of the delivery duct 27 and later returned to the furnace by way of returned duct 28.

A fan 29 or other air delivery means is provided for selectively delivering outside air into the mixing chamber 24 through opening 30 in end wall 17 of the enclosure.

The internal wall 23 has an inlet means 31 in the form of two inlet openings 32 formed in the wall and a fan 33 or other air circulating means located in each opening. With this arrangement, air within the mixing chamber 24 can be delivered into the processing chamber 22.

An air outlet means 34 is provided in the internal wall 23 at a location below the air inlet means 31. The outlet means 34 is in the form of an outlet opening formed in the internal wall 23.

A processing tunnel 36 is provided in the processing chamber 22. The processing tunnel has a top wall 37 and two longitudinal side walls 38. The processing tunnel also has an entry end 39 communicating with the processing chamber 22 and an exit end 40 surrounding said outlet opening 34 in the internal wall 23 whereby heated air passing through the tunnel leaves the tunnel and enters the mixing chamber 24 by way of the outlet opening in the internal wall. A first restriction means 41 is provided at or near the entry end 39 of the processing tunnel to enhance a pressure differential between the exterior and interior of the tunnel, as will be explained later. Similarly, a second restriction means 42 is provided at or near the exit end 40 of the tunnel. The restriction means 41 and 42 may be in a form of a perforated screen constructed from shadecloth or perforated metal. The restriction means 41 and 42 may also serve to provide for a more even distribution of air across the tunnel.

The processing tunnel 36 is defined by a sheet 43 of flexible plastics material which is adapted to be laid over timber positioned in stacks 44 in the processing chamber for drying. The sheet 43 has longitudinal marginal portions providing flaps 45 which are adapted to rest on the floor 18 of the enclosure in sealing contact with the floor. The flaps 45 may be retained in sealing contact with the floor in any suitable manner such as by stacking sand bags or other objects onto the flaps. The edge of the sheet 43 which surrounds the outlet opening 34 in the internal wall 23 is secured to the wall to provide an air-tight seal. With this arrangement, heated air delivered into the processing chamber 24 through inlet means 31 is caused to flow along the chamber above the tunnel 36 and enter the tunnel through entry end 39. The heated air can then flow along the tunnel towards exit end

40 and thereby pass through the stacks 44 of timber within the tunnel. The flexible nature of the sheet 43 ensures that the top and side walls of the tunnel sealingly engage against the stacks of timber within the tunnel and so ensure that circulating air moving through the tunnel passes through airways existing in the stacks of timber.

A damper means (not shown) may be provided in the mixing chamber to regulate the rate of circulation of heated air through the mixing chamber and processing chamber.

Means (not shown) may also be provided for selectively introducing water vapour into the air prior to its introduction into the mixing chamber so as to evaporatively cool the air. Means (not shown) may also be provided for introducing water vapour directly into the processing chamber to regulate the rate at which timber in the processing chamber is dried.

The processing chamber is provided with an exhaust 46 through which air can be discharged to atmosphere as required in order to provide pressure relief when outside air is introduced into the kiln to lower humidity or temperature.

Operation of the kiln will now be described. Stacks of timber to be dried are introduced into the processing chamber through the entrances. The charge of timber is so stacked that heated air can flow through the stack to assist in removal of moisture from the timber. When the timber stacks are in position, the sheet 43 is draped over the timber stacks in the manner of a blanket and the longitudinal flaps 45 positioned and maintained in sealing contact with the floor 18 in any suitable manner such as by stacking sand bags or pieces of timber onto the flaps.

The sheet of material 43 thus creates the tunnel 36 in which the timber is located. Air within the kiln is heated utilising solar radiation. More particularly, the air is heated by direct solar radiation entering the kiln and from heat energy stored in the kiln and in timber within the kiln. Any additional air required can be heated at the furnace and delivered to the mixing chamber 24. If necessary, water-vapour can be introduced into the air according to the rate at which the timber is to be dried. From the mixing chamber, heated air is delivered into the processing chamber 22 through openings 32 in the internal wall. The air circulates through the processing chamber, first passing along the chamber above the processing tunnel 36 and then entering the tunnel through entry end 39. A pressure differential exists within the processing chamber between the exterior and the interior of the processing tunnel, the higher pressure existing exteriorly of the tunnel. As a consequence of this pressure differential, the sheeting 43 is urged into sealing contact with the stacks of timber in the tunnel. Thus, heated air flowing along the tunnel is caused to pass through airways in the stacks of timber. Heated air leaves the exit end 40 of the tunnel and returns to the mixing chamber 24 through outlet opening 34 for recirculation.

High humidity air can be selectively discharged to atmosphere through exhaust 46 as required to provide the desired humidity.

From the foregoing, it is evident that the present embodiment provides a kiln of relatively simple construction which benefits from solar heating and which alleviates the difficulty with conventional timber drying kilns whereby it is necessary to provide baffles between

the stacks of timber and the internal walls of the kiln to overcome the problem of heated air bypassing airways provided in the stacks.

It should be appreciated that the scope of the invention is not limited to the scope of the embodiment described. In particular it should be understood that the present invention can be utilised in processing operations other than drying of timber.

THE CLAIMS defining the invention are as follows:-

1. Apparatus for use in processing a substance with a gaseous fluid comprising a processing chamber for receiving a charge of said substance for processing, an inlet means for introducing gaseous fluid into the processing chamber, an outlet means for removing gaseous fluid from the processing chamber, means defining a fluid flow passage in the chamber, the fluid flow passage having an entry end communicating with said processing chamber and an exit end communicating with said outlet means, the fluid flow passage having a side wall means which is flexible to generally conform to the profile of a charge of said substance positioned in said flow passage for processing.

2. Apparatus according to claim 1 wherein said side wall means is adapted deflect under the influence of fluid pressure in the processing chamber thereby to sealingly contact the charge of substance in said fluid flow passage.

3. Apparatus according to claim 1 or 2 wherein said means defining the fluid flow passage includes a sheet of flexible material which provides a blanket covering for the charge of substance.

4. Apparatus according to claim 3 wherein the flexible sheet has longitudinal marginal portions parallel to the direction of fluid flow through said flow passage and said longitudinal marginal portions are adapted for sealing contact with a wall of the processing chamber.

5. Apparatus according to claim 4 wherein said wall comprises the floor of the processing chamber.

6. Apparatus according to any one of the preceding claims wherein said outlet means comprises an opening in a wall of the processing chamber and said exit end of the fluid flow passage surrounds said opening.

7. Apparatus according to any one of the preceding claims wherein said inlet means is arranged to deliver gaseous fluid into the region of the processing chamber above said fluid flow path.

8. Apparatus according to claim 7 wherein said inlet means includes an inlet opening in the wall of the processing chamber which also contains said outlet opening.

9. Apparatus according to claim 8 wherein said inlet means includes a fan or other delivery means for delivering gaseous fluid into the processing chamber through said inlet opening.

10. Apparatus according to any one of the preceding claims wherein said apparatus further includes a mixing chamber communicating with said inlet and outlet means whereby fluid recirculating through the processing chamber passes through the mixing chamber.

11. Apparatus according to claim 10 wherein a damper means is provided to regulate fluid flow through the mixing chamber between said outlet and inlet openings.

12. Apparatus according to any one of the preceding claims wherein the processing chamber is defined between wall means at least part of which is at least partially

transparent to heat from solar radiation to facilitate heating of the gaseous fluid.

13. Apparatus according to any one of the preceding claims wherein the processing chamber is defined within an enclosure which comprises a frame structure and a covering supported by the frame structure.

14. Apparatus according to claim 13 wherein the covering comprises spaced inner and outer walls.

15. Apparatus according to claim 14 wherein said inner and outer walls are constructed of flexible material.

16. Apparatus according to claim 14 or 15 wherein the spacing between the inner and outer walls is adapted to receive air under pressure to reinforce the covering.

17. Apparatus according to any one of claims 13 to 16 wherein the frame structure comprises a plurality of spaced arch members.

18. A kiln for processing a substance with heated gaseous fluid, the kiln comprising wall means defining a processing chamber, at least part of said wall being at least partially transparent to heat from solar radiation to facilitate heating of gaseous fluid in the processing chamber.

19. A kiln according to claim 18 wherein the processing chamber is defined within an enclosure which comprises a frame structure and a covering supported by the frame structure.

20. A kiln according to claim 19 wherein the covering comprises spaced inner and outer walls.

21. A kiln according to claim 20 wherein said inner and outer walls are constructed of flexible material such as polyester woven scrim.

22. A kiln according to claim 20 or 21 wherein the spacing between the inner and outer walls is adapted to receive air under pressure to reinforce the covering.

23. A kiln according to any one of claims 19 to 22 wherein the frame structure comprises a plurality of spaced arch members.

24. Apparatus substantially as hereindescribed with reference to the accompanying drawings.

25. A kiln substantially as hereindescribed with reference to the accompanying drawings.

AMENDED CLAIMS

[received by the International Bureau on 24 July 1989 (24.07.89)
original claims 2 and 3 cancelled; claims 1 and 4 amended;
other claims unchanged (1 page)]

1. (Amended) Apparatus for use in processing a substance with a gaseous fluid comprising a processing chamber for receiving a charge of said substance for processing, an inlet means for introducing gaseous fluid into the processing chamber, an outlet means for removing gaseous fluid from the processing chamber, means defining a fluid flow passage in the chamber, the fluid flow passage having an entry end communicating with said processing chamber and an exit end communicating with said outlet means, wherein the means defining a fluid flow passage comprises a sheet of flexible material which is impervious to said fluid and which provides a blanket covering for the charge of substance, said sheet being adapted to deflect under the influence of fluid pressure in the processing chamber thereby to sealingly contact the charge of substance in said fluid flow passage.

2. (Cancelled)

3. (Cancelled)

4. (Amended) Apparatus according to claim 1 wherein the flexible sheet has longitudinal marginal portions parallel to the direction of fluid flow through said flow passage and said longitudinal marginal portions are adapted for sealing contact with a wall of the processing chamber.

5. Apparatus according to claim 4 wherein said wall comprises the floor of the processing chamber.

Fig 1

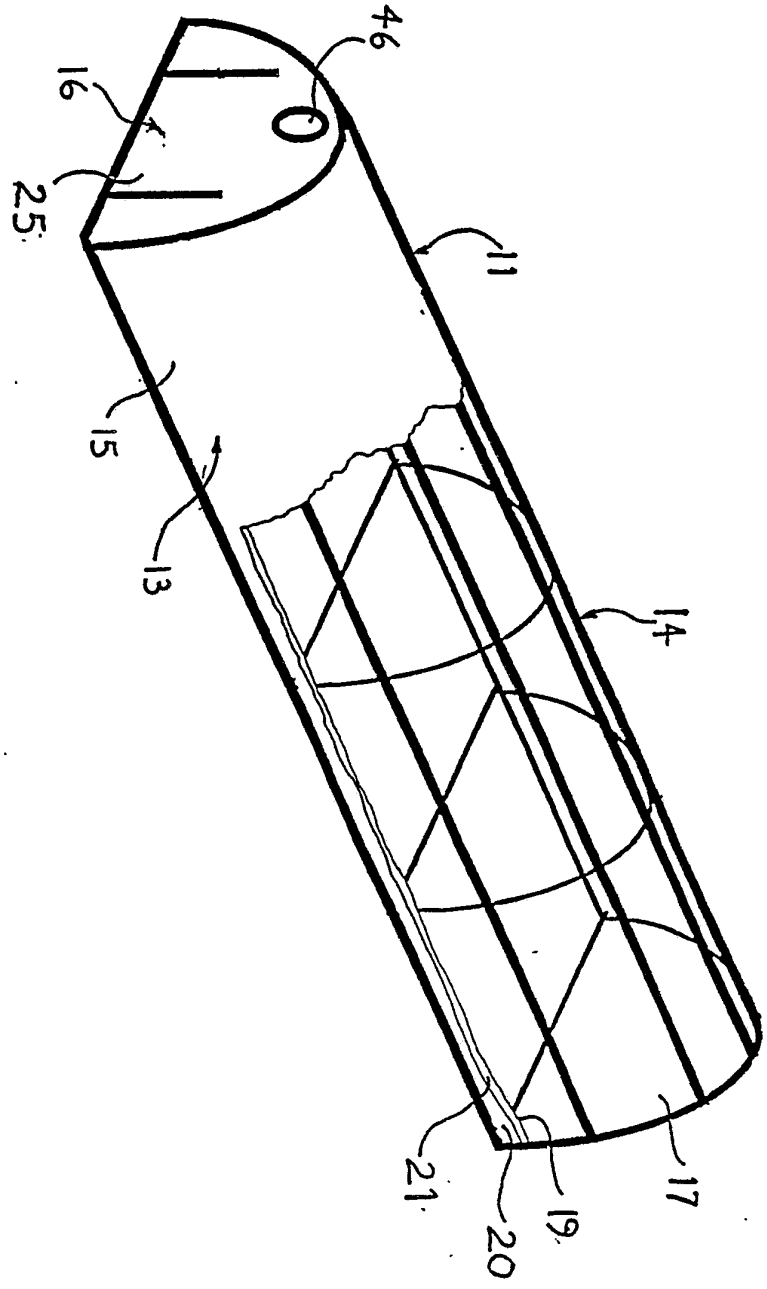
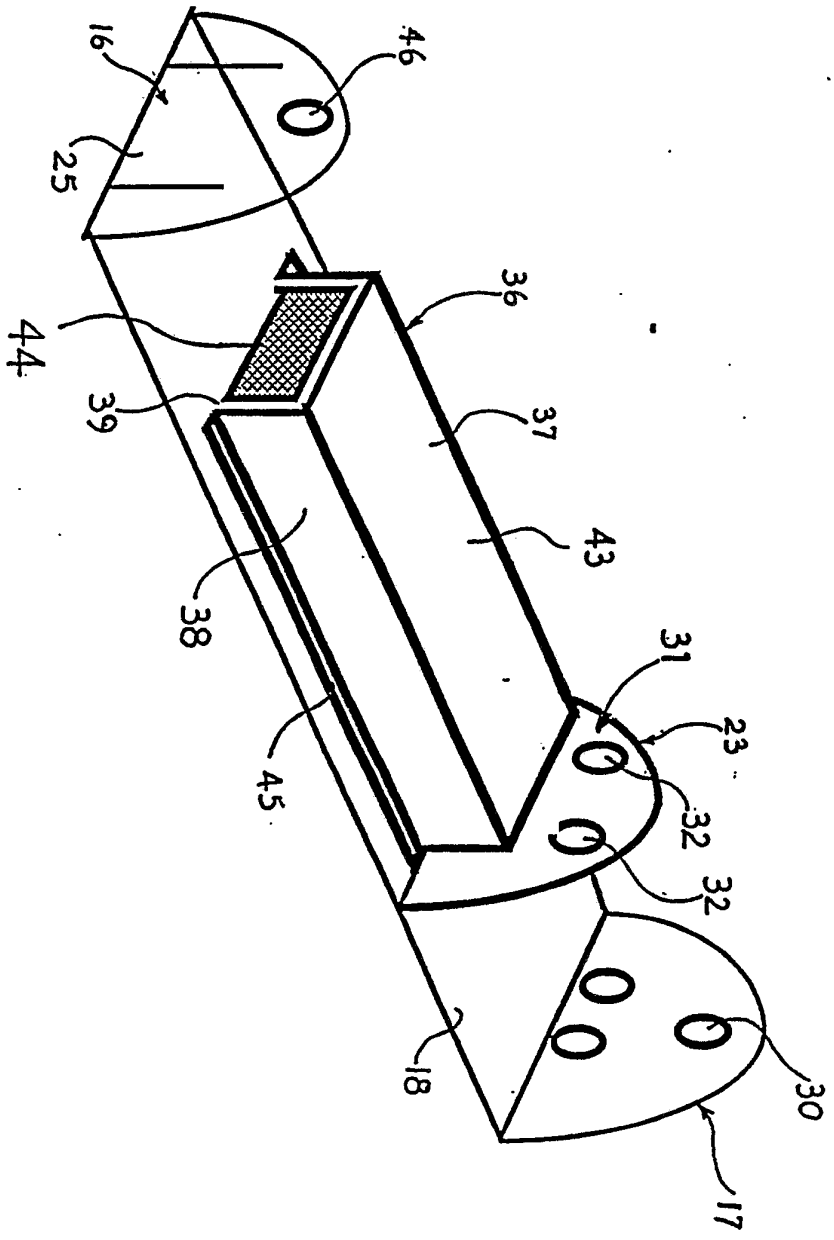


Fig 2



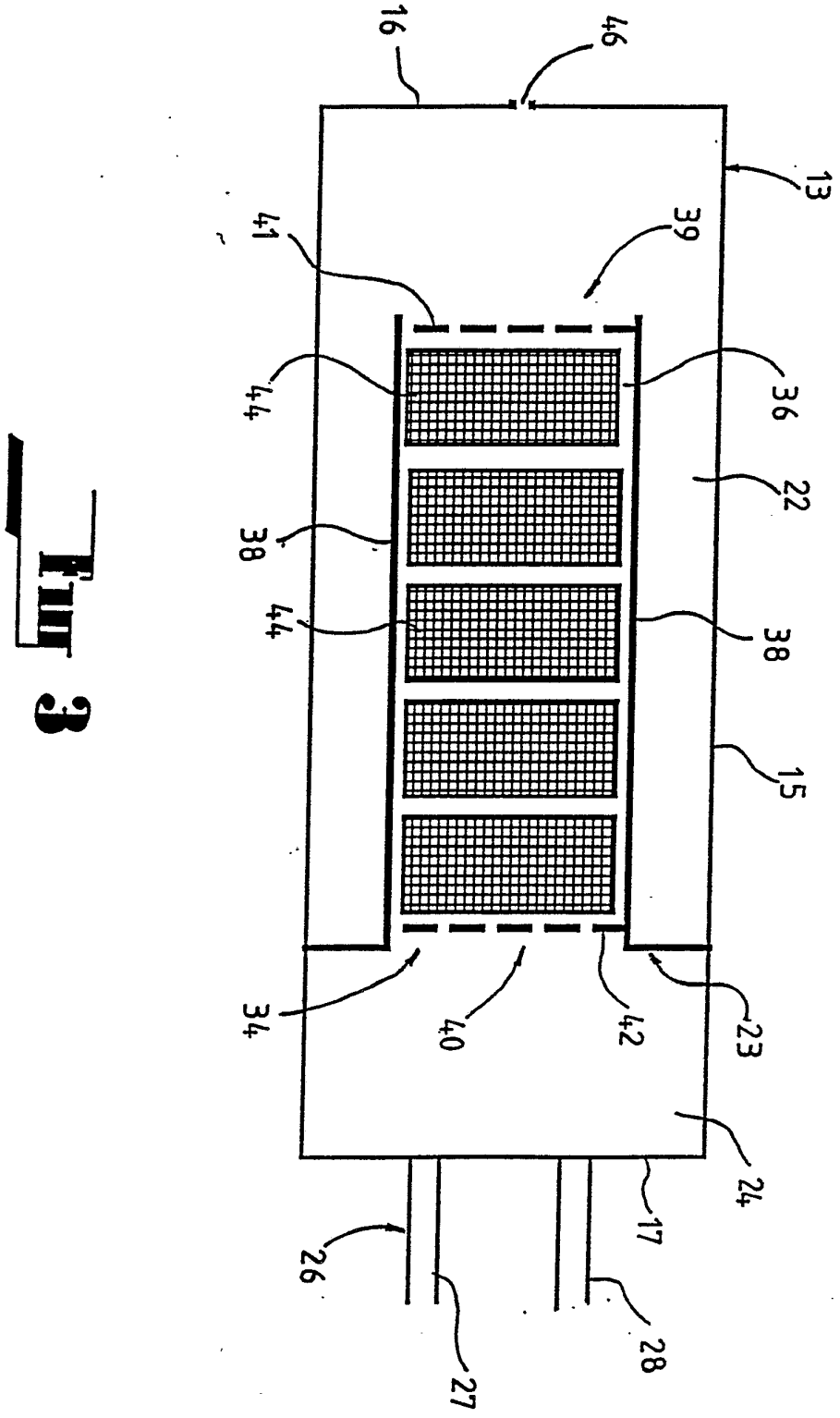


Fig 3

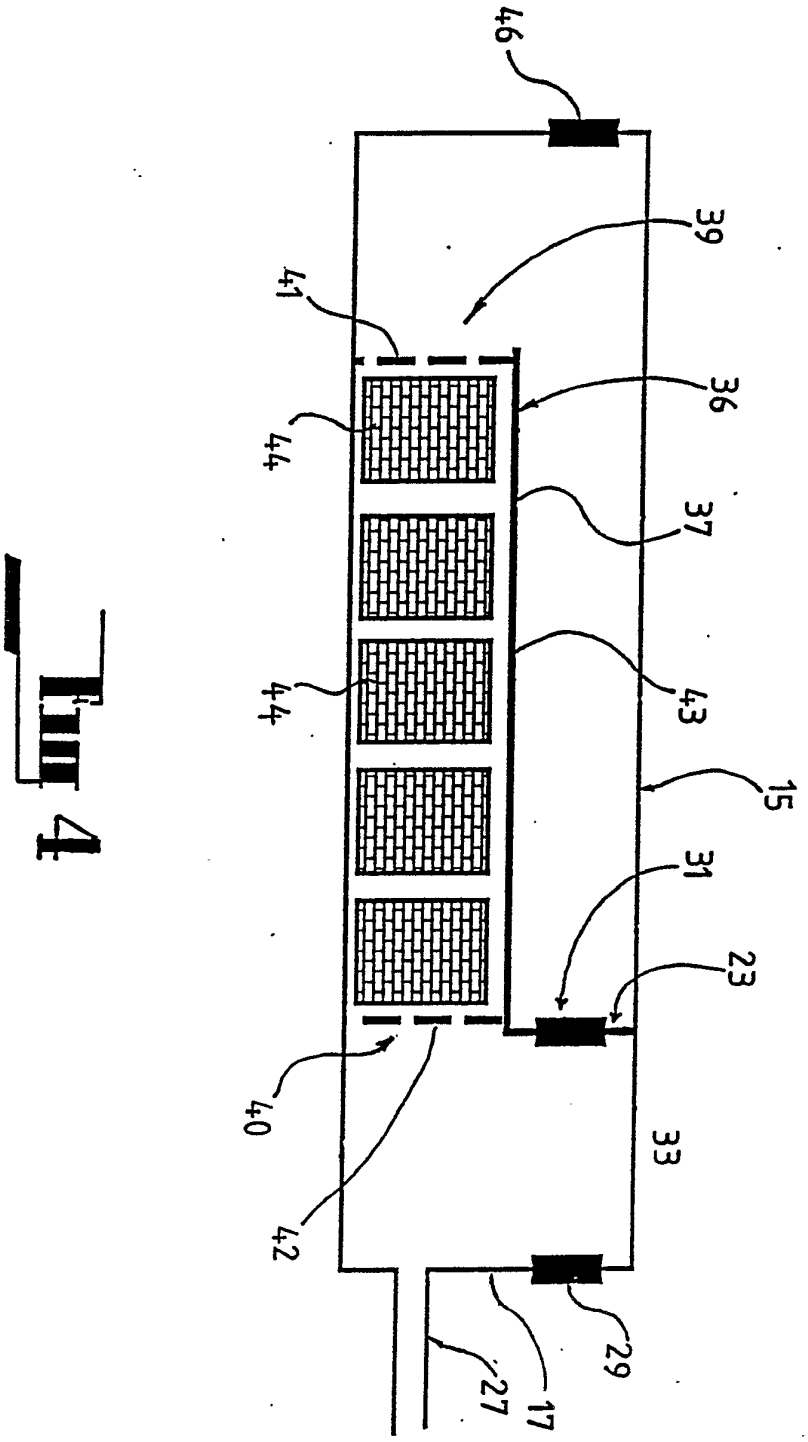


Fig 4

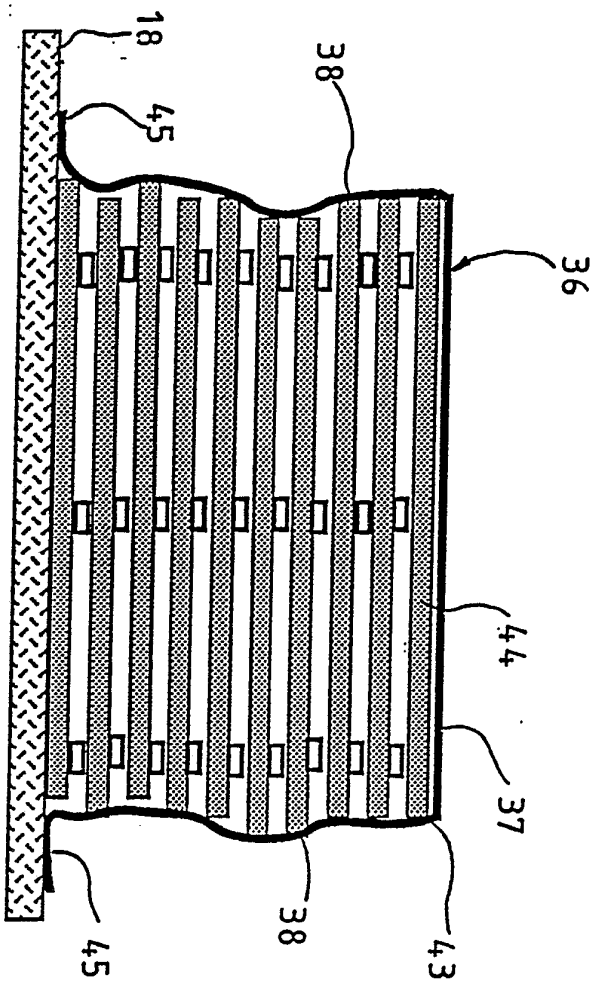


Fig. 5.

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 89/00048

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] F26B 3/28, F24J 2/02

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	F26B 3/28, F24J 2/02, F26B 9/06

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
X	US,A, 3196554 (SMITH) 27 July 1965 (27.07.65)	(1-11)
X	US,A, 4285143 (HUFFORD et al) 25 August 1981 (25.08.81)	(18-20)
X	AU,B, 44402/85 (567403) (HUNT) 19 November 1987 (19.11.87)	(18-20)
X	AU,B, 43831/58 (240600) (JOYCE) 2 June 1960 (02.06.60) See claim 4.	(18-21)
X	DD,A, 206206 (LADWIG et al) 18 January 1984 (18.01.84)	(18-23)
X	WO,A, 81/02777 (FARSJØ) 1 October 1981 (01.10.81)	(1-23)
X	Derwent Abstract Accession no. F8830E/20, Class Q76, SU, 557226 (GEOR POLY) 23 July 1981 (23.07.81)	(18-20)
X	US,A, 4490926 (STOKES) 1 January 1985 (01.01.85)	(18-20)
X	AU,B, 43343/85 (548527) (HARDING) 9 January 1986 (09.01.86)	(18-21)
A	Kreider, J.F., and Kreith, F., 'Solar Energy Handbook', published 1981 by McGraw-Hill Book Company (New York), see pages 18.17 to 18.25	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
12 May 1989 (12.05.89)	24 May 1989 (24.05.89)
International Searching Authority: Australian Patent Office	Signature of Authorized Officer: R.B. CAMPBELL

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