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(54) Blade handling tray insert

(57) A tray insert (10) for securing fluid reaction members in a handling tray (10) includes a body having first and second major surfaces (12A, 12B), first and second ends (14A, 14B), sliding members (18A,18B) disposed on the first and second ends (14A, 14B), which are configured to engage with a plurality of slots (26) formed in the handling tray (20), and a first plurality of sockets (16A) extending into the first major surface (12A), which are spaced from one another to receive and support a plurality of fluid reaction members (28). The tray insert (10) is configured to hold the fluid reaction members (28) in a suspended state, which prevents them from coming into contact with each other or a surface of the handling tray (10).

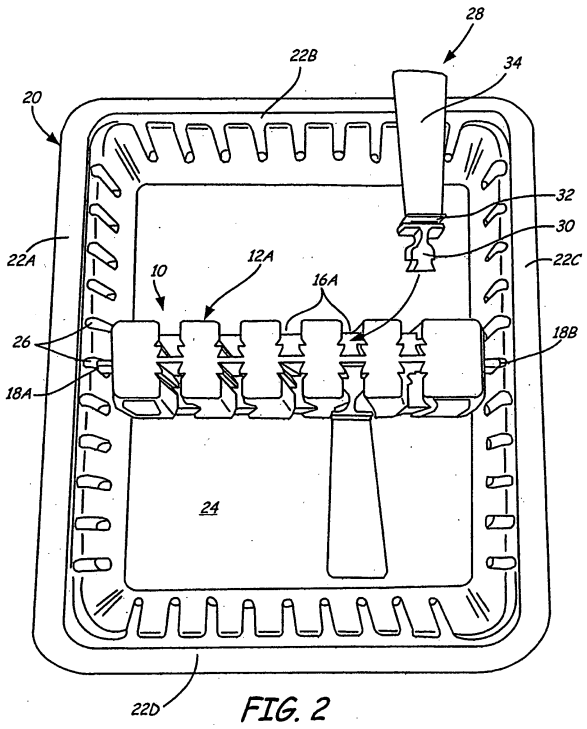


FIG. 2

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Description

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to a tray insert. More particularly this invention relates to a tray insert for securing gas turbine engine blades in a handling tray.

[0002] During operation of a gas turbine engine, fuel is combusted in compressed air created by a compressor to produce heated gases. The heated gases move in a downstream/aft direction past stator vanes and are used to turn turbine blades to produce rotational power for, among other things, operating the compressor. Turbine blades include a root portion, which is commonly shaped like a "fir tree," for engaging with a rotor disk and an airfoil portion for positioning within the gas path of the engine.

[0003] Due to design complexity, gas turbine engines have high manufacturing costs. Therefore, fluid reaction members, such as blades and vanes, are expensive. In addition, the elongated configuration of the airfoil portion of gas turbine engine blades makes them fragile and susceptible to damage. As a result, when moving or transporting gas turbine engine blades, the handler must be extremely careful.

[0004] Known devices and methods for handling gas turbine engine blades are potentially problematic because it is possible for the airfoil portions of the blades to come into contact with each other, causing damage to one or multiple blades. Also, since the airfoil portions of the blades are in contact with surfaces of the receptacle containing the blades, such as a tray, damage to the blades may be incurred when the tray is inappropriately handled. When Process Incidental Damage (PID) occurs, both time and money are lost, as the blades then need to be replaced.

[0005] Therefore, it is desired to provide a blade handling tray insert, which enables gas turbine engine fluid reaction members, especially blades and vanes, to be safely and easily handled, thereby reducing PID.

BRIEF SUMMARY OF THE INVENTION

[0006] From one aspect of the present invention provides a tray insert for securing fluid reaction members in a handling tray. The tray insert includes a body having first and second major surfaces and first and second ends, sliding members disposed on the first and second ends, which are configured to engage with a plurality of slots formed in the handling tray and a first plurality of sockets extending into the first major surface, which are spaced from one another to receive and support a plurality of fluid reaction members. The tray insert is configured to hold the fluid reaction members in a suspended state, which prevents them from coming into contact with each other or a surface of the handling tray.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1A is a perspective view of an exemplary embodiment of a blade handling tray insert.

FIG. 2 is a top view of a handling tray containing the tray insert securing a first blade and receiving a second blade.

FIG. 3 is a top view of the handling tray containing the tray insert securing two blades.

DETAILED DESCRIPTION

[0008] In general, the present invention provides a tray insert for securing fluid reaction members in a handling tray. The tray insert is designed to hold the fluid reaction members, in particular gas turbine engine blades, in a suspended state. This prevents the fluid reaction members from being damaged during handling and/or shipping.

[0009] FIG. 1 is a perspective view of an exemplary embodiment of blade handling tray insert 10. Tray insert 10 includes first major surface 12A, second major surface 12B, first end 14A and second end 14B. First plurality of sockets 16A extend into first major surface 12A. Second plurality of sockets 16B extend into second major surface 12B. Sliding member 18A is disposed on first end 14A. (A second sliding member, sliding member 18B, is disposed on second end 14B, but cannot be seen from this perspective.)

[0010] Tray insert 10 is configured to securely hold a plurality of gas turbine engine blades. Sockets 16A, 16B are each designed to receive a portion of a blade. The spacing of sockets 16A, 16B can vary depending upon the size of the blades (or other types of fluid reaction members) which need to be secured for handling. In the exemplary embodiment shown in FIG. 1, there are ten sockets 16A and ten sockets 16B. However, it should be understood that the number of sockets will vary according to the desired application.

[0011] In addition, in the exemplary embodiment shown in FIG. 1, tray insert 10 includes first major surface 12A, into which sockets 16A extend, and second major surface 12B, into which sockets 16B extend. Sockets 16A are spaced to receive and secure a first type of gas turbine engine blade, such as a first stage blade. Sockets 16B are configured to receive and secure a second type of gas turbine engine blade, such as a second stage blade. Tray insert 10 may be seated in a handling tray such that first major surface 12A is oriented in an upward direction. In contrast, tray insert 10 may also be seated in a handling tray such that second major surface 12B is oriented in an upward direction. As a result, an appropriate major surface 12A, 12B may be selected depending upon which plurality of sockets 16A, 16B corresponds to the shape and size of the blade to be handled. However, if it is desired that only one type of blade be handled, it

should also be understood that plurality of sockets 16A or 16B may extend into only one major surface 12A or 12B of tray insert 10.

[0012] While tray insert 10 may be comprised of any suitable material, in particular, tray insert 10 may be comprised of a polymeric material, such as polyethylene. When comprised of a plastic type material, tray insert 10 may be produced by an injection molding process.

[0013] FIG. 2 is a top view of handling tray 20 containing tray insert 10 and demonstrates the blade insertion process. Tray insert 10 includes first major surface 12A, second major surface 12B, first end 14A and second end 14B, first plurality of sockets 16A and sliding members 18A, 18B. Handling tray 20 includes side portions 22A-22D, bottom portion 24 and receiving slots 26. Gas turbine engine blades 28 include root 30, platform 32 and airfoil 34.

[0014] Tray insert 10 may be seated in handling tray 20 by engaging sliding members 18A, 18B with receiving slots 26, which are formed into the inside surface of side portions 22A-22D of handling tray 20. As can be seen in FIG. 2, side portions 22A-22D of handling tray 20 may comprise a number of receiving slots 26. As a result, tray insert 10 may be placed in numerous positions with respect to handling tray 20 in order to accommodate a variety of blade lengths.

[0015] Once tray insert 10 is firmly seated within handling tray 20, gas turbine engine blade 26 may be inserted into plurality of sockets 16A. (Although FIG. 2 shows tray insert 10 seated in handling tray 20 such that major surface 12A is oriented in an upward direction, as explained with reference to FIG. 1, tray insert 10 may also be seated in handling tray 20 such that major surface 12B is oriented in an upward direction and plurality of sockets 16B are accessible.) Root 30 of gas turbine engine blade 26 is designed to have a "fir tree" configuration, which engages with a rotor disk. Plurality of sockets 16A are configured to engage with root 30 and therefore, have a corresponding "fir tree" shape. Since root 30 and plurality of sockets 16A have a dovetail relationship, as shown in FIG. 2, gas turbine engine blade 26 is inserted into plurality of sockets 16A by matching up the corresponding shapes and lowering blade gas turbine engine blade 26 downward to engage with plurality of sockets 16A like a puzzle piece. Once gas turbine engine blade 26 and plurality of sockets 16A are properly engaged, gas turbine engine blade 26 may only be disengaged through the same angle of insertion.

[0016] FIG. 3 is a top view of handling tray 20 containing tray insert 10 as it secures two gas turbine engine blades 26. Tray insert 10 includes first major surface 12A, second major surface 12B, first end 14A and second end 14B, first plurality of sockets 16A and sliding members 18A, 18B. Handling tray 20 includes side portions 22A-22D, bottom portion 24 and receiving slots 26. Gas turbine engine blades 28 include root 30, platform 32 and airfoil 34.

[0017] As described with respect to FIG. 2, gas turbine engine blades 26 are engaged with plurality of sockets 16A by inserting root 30 into a corresponding socket 16A. When root 30 is properly placed within socket 16A, platform 32 of gas turbine engine blade 26 will sit securely against the surface of tray insert 10. Since root 30 fits snuggly within socket 16A, airfoil 34 is held in a suspended state. This prevents airfoil 34 from coming into contact with other gas turbine engine blades 28 and also prevents airfoil 34 from contacting any surface of handling tray 20. As a result, when handling tray 20 is transported, Process Incidental Damage (PID) is unlikely to occur to gas turbine engine blades 28 because airfoil 34 protected from potential breakage and awareness to the handler is increased due the highly visible state of airfoil 34.

[0018] Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the scope of the invention.

Claims

1. A tray insert (10) for securing fluid reaction members (28) in a handling tray (20), the tray insert (10) comprising:

   a body having first and second major surfaces (12A, 12B) and first and second ends (14A, 14B);
   sliding members (18A, 18B) disposed on the first and second ends (14A, 14B), the sliding members (18A, 18B) being configured to engage with a plurality of slots (26) formed in the handling tray (20); and
   a first plurality of sockets (16A) extending into the first major surface (12A) and being spaced from one another to receive and support a first plurality of fluid reaction members (28), wherein the tray insert (10) is configured to hold the first plurality of fluid reaction members (28) in a suspended state, which prevents the fluid reaction members (28) from coming into contact with each other or a surface of the handling tray (20).

2. The tray insert of claim 1, comprising a second plurality of sockets (16B) extending into the second major surface (12B) and being spaced from one another to receive and support a second plurality of fluid reaction members (28).

3. The tray insert of claim 2, wherein the tray insert (10) is insertable into the handling tray (20) such that the first major surface (12A) is positioned in an upward orientation allowing the first plurality of sockets (16A) to be utilized.

4. The tray insert of claim 2 or 3, wherein the tray insert

(10) is insertable into the handling tray such that the second major surface (12B) is positioned in an upward orientation allowing the second plurality of slots (12B) to be utilized.

5. The tray insert of claim 2, 3 or 4 wherein the first plurality of sockets (16A) are configured to receive a plurality of fluid reaction members (28) having a first configuration and the second plurality of sockets (16B) are configured to receive a plurality of fluid reaction members (28) having a second configuration which is different than the first configuration.

6. The tray insert of any of claims 2 to 5, wherein the first and second pluralities of sockets (16A, 16B) each comprises ten sockets.

7. The tray insert of any of claims 2 to 6, wherein the first and second pluralities of sockets (16A, 16B) are further configured to receive the plurality of fluid reaction members (28) from a defined angle of insertion.

8. The tray insert of claim 7 wherein the plurality of fluid reaction members (28) may only be disengaged from the first and second pluralities of sockets (16A,16B) from the defined angle of insertion.

9. The tray insert of any preceding claim, wherein the tray insert (10) is further configured to hold the plurality of fluid reaction members (28) in a suspended state in which the fluid reaction members are suspended in an orientation parallel to a bottom surface of the handling tray (20).

10. A tray insert (10) for securely handling gas turbine engine blades (28), the tray insert (10) comprising:

a body comprising first and second receiving surfaces (12A, 12B) and first and second ends (14A, 14B) wherein the first and second receiving surfaces (12A, 12B) each comprise a plurality of cavities (16A, 16B) each configured to mate with and being spaced to support a root portion (30) of a gas turbine engine blade (28); sliding connectors (18A, 18B) located on the first and second ends (14A, 14B) configured for sliding engagement with a plurality of slots (26) formed in a handling tray (20); and
wherein the tray insert (10) is configured to hold a plurality of gas turbine engine blades (28) in an orientation which prevents an airfoil portion of each gas turbine engine blade (28) from coming into contact with any surface.

11. The tray insert of claim 10, wherein the tray insert (10) may be seated in the handling tray (20) such that the first receiving surface (12A) is positioned in an upward orientation which allows the first plurality of cavities (16A) to each receive a root portion (30) of a gas turbine engine blade (28).

12. The tray insert of claim 10 or 11, wherein the tray insert (10) may be seated in the handling tray (20) such that the second receiving surface (12B) is positioned in an upward orientation which allows the second plurality of cavities (16B) to each receive a root portion (30) of a gas turbine engine blade (28).

13. The tray insert of claim 10, 11 or 12, wherein the first plurality of cavities (16A) are configured to each receive a root portion (30) having a first shape and the second plurality of cavities (16B) are configured to each receive a root portion (20) having a second shape which is different than the first shape.

14. The tray insert of any of claim 10 to 13, wherein the tray insert (10) is further configured to hold the root portions (30) so that the airfoil portions are suspended in an orientation parallel to a bottom surface of the handling tray (20).

15. The tray insert of any of claims 10 to 14, wherein the first and second pluralities of cavities (16A, 16B) are further configured to receive the plurality of gas turbine engine blades (28) from a defined angle of insertion.

16. The tray insert of claim 15 wherein the plurality of gas turbine engine blades (28) may only be disengaged from the first and second plurality of cavities (16A, 16B) from the defined angle of insertion.

17. The tray insert of any preceding claim, wherein the tray insert (10) is composed of a polymeric material.

18. A method for securing and handling gas turbine engine blades (28) in a tray insert (10) of a handling tray (20), the method comprising:

seating the tray insert (10) in the handling tray (20) by inserting sliding members (18A, 18B) disposed on first and second end (14A, 14B) of the tray insert (10) into a plurality of slots (26) formed in the handling tray (20) so that a first receiving surface (12A) is positioned in an upward orientation; and
inserting root portions (30) of a plurality of gas turbine engine blades (28) into a plurality of cavities (16A) extending into the first receiving surface (12A) which each have a configuration corresponding to the specific configuration of the root portions (30) and are spaced from each other such that airfoil portions of the gas turbine engine blades (28) are suspended in an orientation which prevents them from coming into

contact with each other or any surface of the handling tray.

19. The method of claim 19 wherein root portions (30) of a plurality of gas turbine engine blades (28) may be inserted into a plurality of cavities (16B) extending into a second receiving surface (12B) depending on the specific configuration of the root portions (30) of the plurality of gas turbine engine blades (28) to be secured.

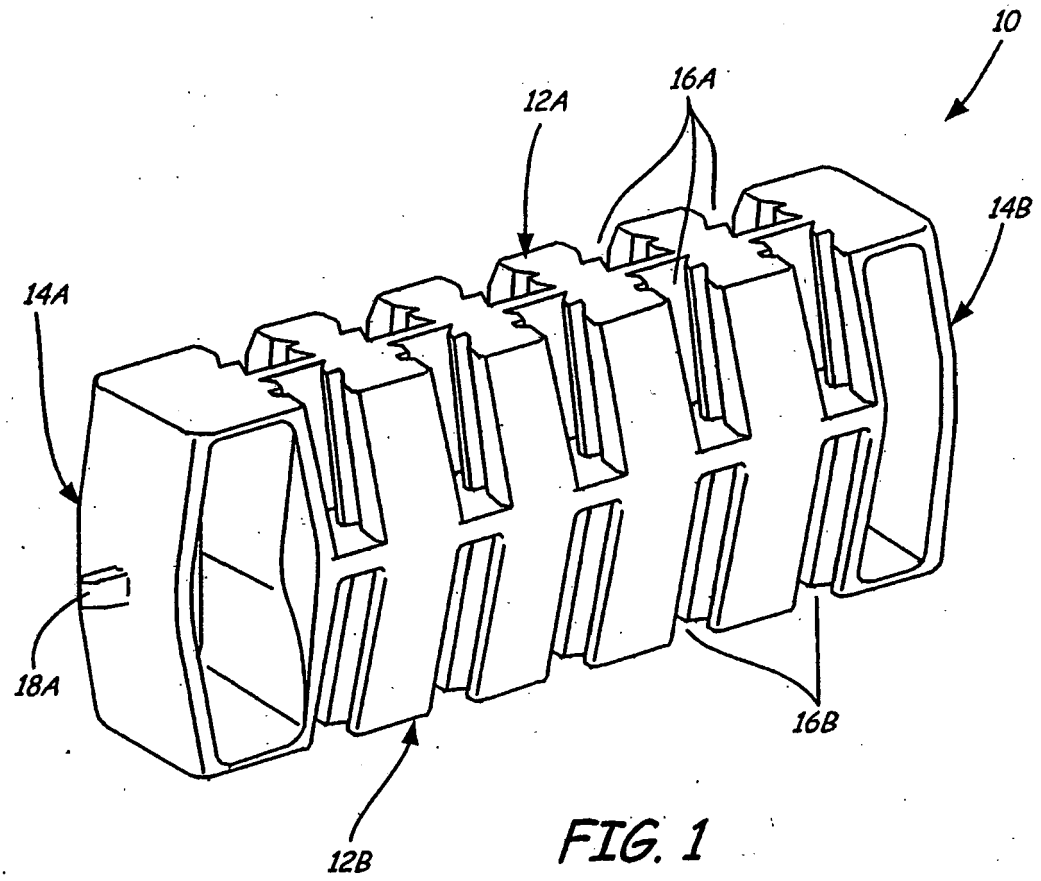


FIG. 1

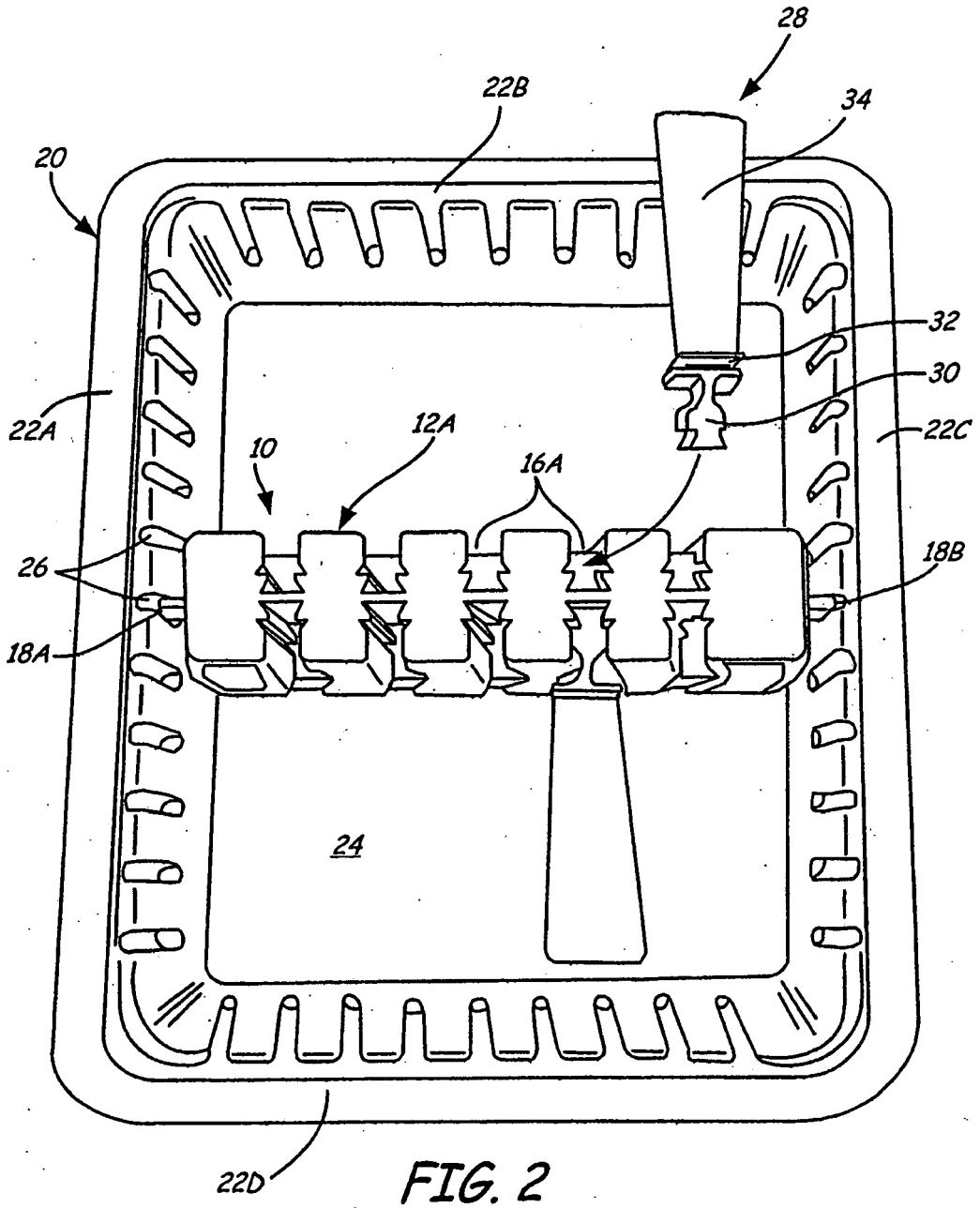


FIG. 2

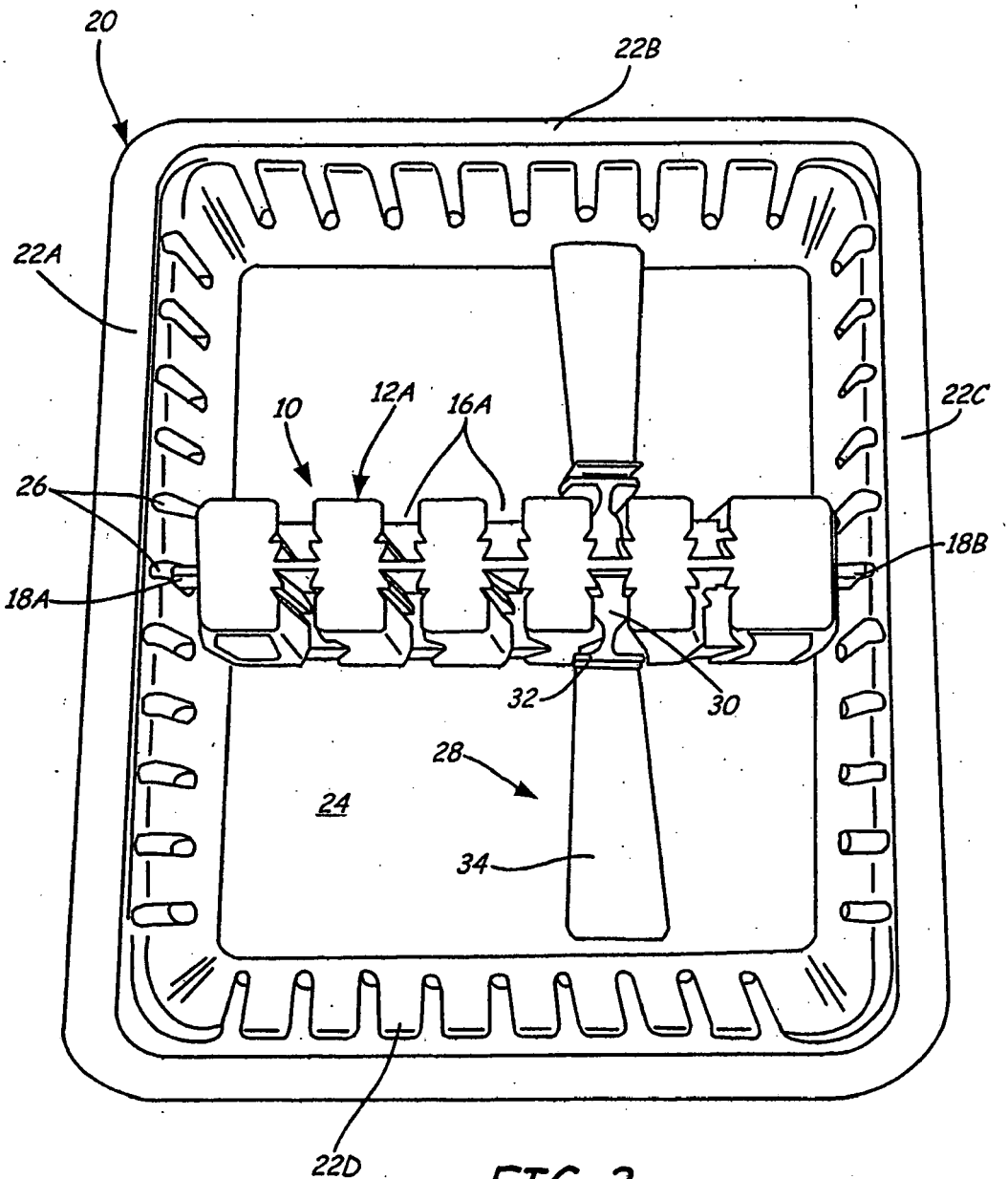


FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 07 25 4209

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 February 2008	SERGIO DE JESUS, E

CATEGORY OF CITED DOCUMENTS

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