(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 619 460 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.01.2006 Bulletin 2006/04

(51) Int Cl.:
F26B 25/18 *(2006.01)*

(21) Application number: **05015775.9**

(22) Date of filing: **20.07.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **23.07.2004 IT CR20040013**
18.11.2004 IT CR20040019

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(54) Tray for drying foodstuffs, particularly pasta

(57) A tray (1) for drying foodstuffs, particularly pasta, having a plastic single-piece frame structure comprising longitudinal sides (2), main cross beams (3) and a net (4) for supporting the foodstuffs. According to a preferred embodiment, the frame is molded in a single piece, and the net (4) is welded along its perimeter; according to a further embodiment, a top half-frame (105) and a bottom half-frame (106) are molded in a single piece and welded together with the net (4) forming the said single-piece structure; preferred processes for making the tray are also disclosed.

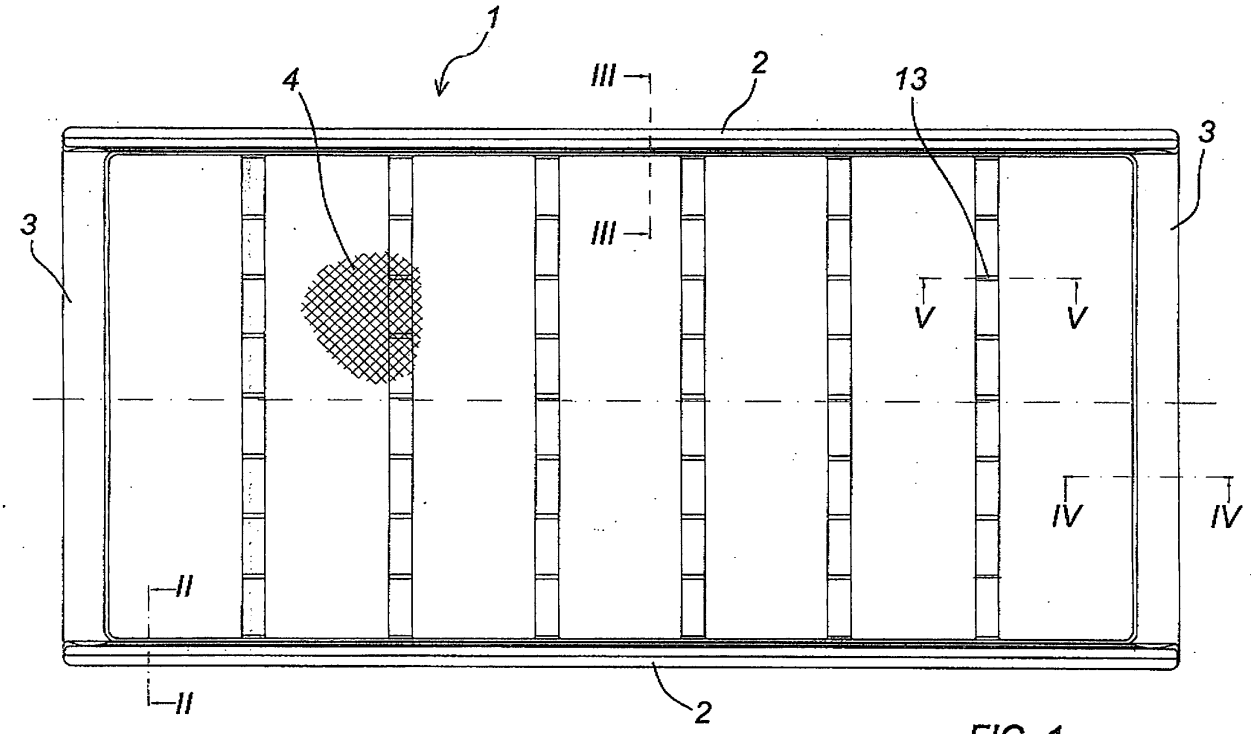

FIG. 1

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Description

[0001] The present invention relates to a tray for drying foodstuffs, particularly pasta. More in detail, the invention relates to a new plastic tray and a preferred process for realizing said tray.

[0002] Drying treatments are well known in the food industry. A common technique, especially for pasta, is to load the product on suitable supporting trays which are then inserted into hot-air drying ovens.

[0003] According to known art, the trays are essentially formed by an external rigid frame, which supports a net (or grate) where the food product is loaded. The frame is generally rectangular, with two longitudinal sides and two main cross beams. Some intermediate, smaller beams may also be provided, to stiffen the tray and to support the net, avoiding an excessive deformation under the weight of the drying product. The material of the tray may be wood, plastics, stainless steel or aluminium alloy.

[0004] The frame is made by a number of fixed or screwed elements; the net is fixed to the frame along its perimeter, at about half-height of the frame itself. The sides of the frame are shaped on their upper and lower faces, for the trays to be easily stacked inside the drying oven.

[0005] The direction of the hot air flow is generally parallel to the longitudinal sides of the trays, i.e. perpendicular to the cross beams.

[0006] The known trays have many disadvantages that have not been solved yet.

[0007] First, the structure made of several parts makes the tray less hygienic and more difficult to clean. In fact, some small gaps are necessarily formed between the contiguous parts and around the fixing screws or other fixing means, being very difficult to clean and thus a good receptacle for dirt, residues, bacteria. A perfect cleaning of the equipments is of the utmost importance in the food industry, and any obstacle to this is a major disadvantage.

[0008] The structure made of several joined parts also results in a more expensive and more complicated item.

[0009] The main cross beams have generally a sharp-edged, square or rectangular cross-section, and the height of said beams is only a little less than the height of the longitudinal sides. As a consequence, some negative effects on the hot air flow arise: the flow is significantly disturbed by the cross beams and the flow resistance is high; when the trays are stacked in their normal working conditions, a little air passage is left between the cross beams, further increasing the flow resistance and forming undesired turbulences.

[0010] The cross beams, being so arranged, are also responsible of a remarkable slip effect (i.e. detachment of the hot air flow from the surface of the profile). The product behind the cross beams remains between a more or less turbulent slipstream, and is not fully exposed to the hot air flow, contrary to the product in the middle of the tray.

[0011] The disadvantageous effects are: first, the quality of the product is not uniform, as some product is correctly dried, while some other product - closer to the longitudinal sides, and more particularly behind the cross beams - is not well exposed to the hot air flow and remains humid; further, more energy is spent for blowing the hot air, due to the high flow resistance, and this increased energy consumption, on a long-term basis, is not negligeable.

[0012] The small beams for supporting the net are further elements disturbing the hot air flow, particularly under the net.

[0013] It should be noted that, as the drying treatment is very important for the quality of the product, the hot air flow should be as uniform and well-distributed as possible. Generally speaking, the tray should be designed to avoid these slip-effects, and to avoid that some portions of the net are under- or overexposed to the hot air flow.

[0014] Referring now to dry pasta, for example, a correct drying treatment is important to give the pasta the desired humidity, a brighter yellow colour and better cooking performance, and to obtain a product free from cracks and breaks.

[0015] Further problems are related to the material of the tray.

[0016] Wood trays are still widely used, but give even more problems from the hygienic point of view, due to the natural porosity of wood which absorbs humidity and favours the growth of bacteria. Furthermore, the humid pasta does not slip freely on the wood surface, so that the uniform distribution of the pasta during the loading phase is impaired.

[0017] Wood has other disadvantages, including warping and deformation with the passing of time, being not well suited for an industrial equipment subject to intense use. The tray may also lose some wood chips, that could be mixed with the product. Wood trays with metal beams are also realized, but the above problems remain unsolved.

[0018] Plastic trays give only a partial solution to these problems, but introduce further disadvantages. In fact, they are made by an even greater number of parts, compared to wood trays; they often have two-piece longitudinal sides, with several fixing screws and, hence, several unhygienic gaps. The frame of known plastic trays is generally made of U-shaped elements, facing each other, thus forming an internal chamber that is a dangerous receptacle for dirt and bacteria, and cannot be accessed for cleaning unless the tray is dismantled.

[0019] Low stiffness is another disadvantage of plastic trays, giving problems during the handling, loading and unloading of the product. For these reasons, plastic trays have so far encountered a poor success on the market.

[0020] Metal trays, generally made of aluminium alloys, also comprise several parts, normally made with extruded beams closed by plastic caps, still having the problem of the unhygienic gaps.

[0021] Moreover, metal trays are rapidly heated to about the same temperature of the hot air, which is com-

monly 70 °C, but in some cases may reach 90 °C, due to their good heat exchange capability. This however results in another disadvantage, because the heat absorbed by the tray is obviously a wasted heat, increasing the hot air consumption; the product that is in direct contact with the hot tray is overdried; hot trays are difficult to handle for extracting them from the oven, emptying and re-loading.

[0022] The aim of the invention is to eliminate or reduce, as far as possible, the above disadvantages of known trays for drying pasta and other food products.

[0023] A first aim of the invention is to realize a tray that can be perfectly cleaned and sanitised, having no gaps or receptacles where dirt and bacteria may accumulate. A purpose of the invention is also to give the tray a good mechanical stiffness, to avoid an excessive deformation under the weight of the product and to be more handy.

[0024] A further aim is to keep the hot air flow uniformly distributed on the net, so that the food product is uniformly dried, following the correct drying cycle, and avoiding that some product is excessively dry or still humid at the end of the treatment.

[0025] Still another aim is to achieve, through the performance of the tray, a better efficiency in terms of quantity of dried product vs. hot air consumption.

[0026] These aims are reached by a tray for drying foodstuffs, particularly pasta, characterised by a plastic single-piece frame structure, comprising longitudinal sides, main cross beams and a central net for supporting said foodstuffs.

[0027] According to one aspect of the invention, to achieve a better efficiency of the tray, the main cross beams have a shaped, aerodynamic profile reducuing the perturbation on the drying hot air flow. The profile of the main cross beams is optimized to reduce the disturbance to the air flow, particularly slip-effect and formation of turbulences. Preferably, the cross section of the beams is considerably less high compared to that of the longitudinal sides, to reduce the inlet losses of the air flow.

[0028] The shaped cross beams, according to a preferred embodiment, have a cross section substantially oval and asymmetrical with respect to the horizontal plane, as it will be explained below.

[0029] According to a further aspect of the invention, to optimise practicalness and efficiency, the tray comprises small beams to support the net, which are part of said single-piece structure, and are also shaped like the main cross beams.

[0030] Preferably, said small beams are located some millimetres below the net, and comprise a plurality of supports for supporting the net in discrete points. These discrete supports allow the hot air to flow directly under the net.

[0031] Any plastic material can be used, provided it is suited for contacting foodstuffs; the preferred material is polypropylene for foods.

[0032] According to a preferred embodiment, the single-piece structure is obtained with a frame molded in one piece, forming the longitudinal sides and cross beams, the net being welded to said frame.

[0033] A preferred process to realize the tray with this structure consists in making the frame by gas-molding of a single piece, and then welding the net on the frame by hot-blade process; the net is welded to a suitable step provided on the internal side of the frame.

[0034] Another embodiment provides a top and a bottom half-frame, each of them molded in a single piece, which are welded together in correspondence of the plane of the net. The net is welded between said two half-frames, thus forming a tray with a "monolithic" single-piece structure.

[0035] A preferred process to obtain the tray with the above structure based on welded half-frames essentially comprises the following phases: molding of the bottom half-frame, placing the net; molding of the top half-frame, to weld on said bottom half-frame, obtaining a single-piece structure free of screws or other connecting means.

[0036] In both cases, gas-molding is preferred, allowing to obtain hollow parts for reducing the weight and the material used.

[0037] The tray with single-piece structure, free of screws and gaps, is more hygienic and can be perfectly sanitised; it is also less expensive, it is light and easy to handle, but strong. The single-piece structure is also advantageous from the point of view of stiffness, giving a plastic tray with good mechanical performance, contrary to known plastic trays that have the disadvantage of a low stiffness.

[0038] The aerodynamically shaped cross beams lowers the flow resistance and keep to a minimum the aforesaid slip-effect. This results in a more uniform hot air distribution on the net, so that the product can be more uniformly dried; this also results in a lower energy demand for producing and blowing the hot air, for a given quantity of dried product.

[0039] The reduced front section of the main cross beams is another advantageous feature, leaving a sufficient passage for the air, so as to limit the perturbance to the flow and, again, the flow resistance, when the trays are stacked inside the oven.

[0040] The small beams supporting the net in discrete points allow the hot air flow to lap the bottom surface of the net, giving a further advantage in terms of uniformity of the drying treatment.

[0041] The more uniform and less disturbed hot air flow yields a finer quality of the product, that is dried homogeneously and respecting the parameters of the working cycle.

[0042] These and other features and advantages will be more apparent hereinbelow, with the help of a description of preferred, non-limitative embodiments, and with the help of the accompanying figures, wherein:

Fig. 1 is a top view of a tray according to the invention,

with frame molded in a single piece and welded net;
Figs. 2 to 5 are cutaway views of the tray of Fig. 1, according to planes II-II, III-III, IV-IV and V-V;
Fig. 6 is a top view of a tray according to the invention, made with a frame formed by two half-frames welded in correspondence of the net;
Figs. 7 to 9 are cutaway views of the tray of Fig. 6, according to planes VII-VII, VIII-VIII and IX-IX;
Fig. 10 is a representation of the shaped profile of the cross beams of the tray shown in Fig. 6, according to a preferred embodiment;
Fig. 11 is a sketch showing two trays, like the one of Fig. 1 or the one of Fig. 6, in their working position inside the drying oven; the hot air flow is also shown.

[0043] Referring now to Figs. 1 to 5, a tray 1 for drying food products, particularly pasta, is shown, essentially comprising an external frame, made by longitudinal sides 2 and main cross beams 3, and a net 4 for supporting the drying product.

[0044] The frame of the tray is molded in a single piece, forming the longitudinal sides 2 and main cross beams 3; the preferred material is polypropylene suitable for foods.

[0045] The longitudinal sides 2 (Fig. 2) have a hollow structure, and an upper face 10 and lower face 11 with matching profiles, allowing the trays to be stacked one onto the other. More in detail, the upper face 10 exhibits a protruding part on the inner side (towards the net 4), while the lower face 11 exhibits a protruding part on the opposite outer side. The matching profiles block the lateral movement between the trays, but allow longitudinal sliding.

[0046] The sides 2 have an internal face 12, towards the net 4, preferably with a remarkable lip clearance angle (e.g. 10 degrees) to increase the load capacity of the tray.

[0047] The front section of cross beams 3 is entirely comprised in the height of longitudinal sides 2, and preferably the height of the cross beams 3 is notably less than the height of edges 2, about 50%, to leave a wide passage area for the hot air flow when the trays are stacked in the drying oven.

[0048] In a preferred embodiment, stiffening small beams 13 are also provided, extending some millimeters below the net 4. Said small beams 13 provide supports 14 for the above net 4, supporting said net in discrete points, and defining air passages 15 through which the hot air can directly lap the net 4.

[0049] A preferred form of the main cross beams 3 is shown in the cutaway view of Fig. 4, wherein the beams 3 have a hollow structure and are shaped substantially with an oval profile. More in detail, the profile of the main cross beams 3 has an upper face 21 following a circular arc, and a lower face 22 also following a circular arc, with a greater radius. Preferably, the radius of the lower face 22 is about 1.5 times the radius of the upper face 21.

[0050] As an example, in a tray for drying pasta where the sides 2 are 60 mm high, the profile of the upper face 21 follows an arc with a radius of 25 mm, while the lower face 22 follows an arc with a radius of 45 mm. The front section is about 28 mm.

[0051] Fig. 5 shows a preferred form of the small beams 13, wherein the cross-section of said beams 13 appears as a "C" facing downwards.

[0052] A preferred process to fix the net 4 to the tray 1 is the following: to this purpose, the tray 1 is realized with a step 30 (Figs. 2 and 3), that is heated and locally melted with a hot blade device; the net is placed on the heated step 30 and then is cold-pressed; the edges of the net 4 penetrate through the hotted material of the step 30, which is softened by the high temperature and flows through the holes of the net 4 itself; when cooled, the net 4 remains "trapped" into the frame, no gaps or holes are formed between the net and the frame and, obviously, no fixing screws are required.

[0053] The net is continuously fed from a roll, or previously cut to the desired dimensions.

[0054] Turning now to Figs. 6 to 10, another embodiment of the tray 1 is shown, wherein the main components are still a frame made of lateral sides 2 and main cross beams 3, and a net 4 fixed to said frame.

[0055] The frame (Fig. 7) is made essentially with a top half-frame 105 and a bottom half-frame 106. Both the top half-frame 105 and bottom half-frame 106 are molded in a single piece, and coupled, preferably by welding, along a rim 107, about in a median position substantially corresponding to the plane of the net 4.

[0056] The half frames 105 and 106 are intended as realized in a single piece with the exception of possible non-structural accessories, that is when the main elements, i.e. the longitudinal sides and cross beams, are parts of a single body and are not to be assembled with screws, couplings or equivalent means.

[0057] The longitudinal sides 2 have an upper face 110 and a lower face 111 with matching profiles, allowing the trays to be stacked. The sides 2 have an internal face 112, towards the net 4, preferably with a remarkable lip clearance angle (e.g. 10 degrees) to increase the load capacity of the tray.

[0058] As above, the main cross beams 3 have a shaped profile, to reduce the flow resistance and disturbance to the hot air flow, and the front section of cross beams 3 is such to leave a wide passage area for the hot air flow when the trays are stacked in the drying oven.

[0059] The tray may comprise small stiffening beams 113, which in this embodiment may be formed with the lower half-frame 106.

[0060] Preferably, the small beams 113 have a shaped profile like the main beams 3, and are located some millimeters below the net 4, with supports 114 extending towards the above net 4, for supporting said net in discrete points. Said supports 114 keep the net 4 distanced from the small beams 113, defining passages 115 for the hot air directly lapping the net 4.

[0061] A preferred section of cross beams 3 (Fig. 10) is substantially oval with an upper face 121 and a lower

face 122 substantially following a circular arc, the lower face with a greater radius. Referring to Fig. 10, the radius R2 of the lower face 122 is preferably about 1.5 times the radius R1 of the upper face 121. Fig. 10 refers to an embodiment where sides 2 are about 60 mm high, R1 is about 30 mm, R2 is about 45 mm, R3 is about 8 mm. The front section "d" is about 28 mm.

[0062] The profile of small beams 113 may be similar to that of main beams 3 (Fig. 9), or an open, C-shaped profile like that of Fig. 5.

[0063] A preferred process for making the tray according to the embodiment of Figs. 6-10 is the following: molding of bottom half-frame 106; placing the net 4 on said bottom half-frame 106; molding of top half-frame 105, to weld on said bottom half-frame 106;

[0064] This process realizes a tray which is actually a single piece, with no screws, linking means or those gaps between contiguous elements, which are found in known trays formed by a plurality of parts.

[0065] Although Figs. 6 to 10 show sides 2 and cross beams 3 with a solid section, they may also have a hollow structure obtained e.g. by gas molding.

[0066] The preferred material is polypropylene, for both the tray 1 and the net 4. Equivalent embodiments are also possible with other plastic materials and/or with a net made of a material different from that of the tray, to remain incorporated in the plastic frame.

[0067] During the use, the trays are loaded with pasta or another vegetal or animal food product, and stacked inside the drying oven as shown in Fig. 11.

[0068] Referring to said Fig. 11, two trays are shown as 1 a and 1b; the respective main cross beams are shown as 3a and 3b, and the nets are shown as 4a and 4b. The hot air flow is indicated as F; the minimum section S available to the hot air flow, between cross beams 3a and 3b, is also shown.

[0069] The hot air flow F follows the shaped profiles of beams 3a and 3b, thus reducing undesired slip effect, vortexes and turbulences; also the product resting behind the beams 3a and 3b is exposed to the hot air flow and correctly dried.

[0070] Thanks to the above described arrangement of cross beams 3a and 3b, the section S is greater than the same section of known trays, wherein the cross beams are rectangular or squared, with about the same height as the longitudinal sides. In practice, the section S does not create a sharp throttle for the flow F, avoiding slip-effect and turbulence, and limiting losses and energy consumption.

[0071] The above arrangement of the small beams 13, 113 and net supports 14, 114 further contributes to uniformity of hot air flow F.

[0072] The tray according to the invention meets the above aims and purposes, being easy to handle, perfectly cleanable, with the aforesaid advantages of product quality and working efficiency.

Claims

1. A tray (1) for drying foodstuffs, particularly pasta, **characterised by** a plastic single-piece frame structure, comprising longitudinal sides (2), main cross beams (3) and a central net (4) for supporting said foodstuffs.

2. A tray according to claim 1, **characterised by** said main cross beams (3) having a shaped profile adapted to reduce the perturbation of the drying hot air, during the use.

3. A tray according to claim 1 or 2, **characterised by** said structure comprising small beams (13, 113) connecting the longitudinal sides (2), and disposed to support said net (4) between the main cross beams (3), said small beams (13, 113) having a shaped profile adapted to reduce the perturbation of the drying hot air, during the use.

4. A tray according to claim 3, **characterised by** said small beams (13, 113) comprising a plurality of supports (14, 114) extending towards the net (4) and supporting said net (4) in discrete points, defining passages (15, 115) between said supports (14, 114) for the hot drying air under said net (4).

5. A tray according to claim 2, **characterised by** the fact that the shaped profile of said main cross beams (3) is substantially oval, having an upper face (21, 121) following a circular arc of a first radius, and a lower face (22, 122) following a circular arc of a second radius, greater than the first.

6. A tray according to any one of preceding claims, **characterised by** the fact that said structure comprises a frame molded in a single piece to form said longitudinal sides (2), cross beams (3) and, when provided, small beams (13) and supports (14), and said net (4) is welded along the perimeter of said frame.

7. A tray according to any one of preceding claims, **characterised by** the fact that said structure comprise a frame formed by a top half-frame (105) and a bottom half-frame (106), both molded in a single piece and coupled at about the plane of said net (4).

8. A tray according to claim 7, **characterised by** the fact that the small beams (113) are molded in a single piece with said bottom half-frame (106).

9. A process for realizing a tray for drying food, said tray having a structure according to claim 6, **characterised by** the following steps:

- a step (30) provided on the tray (1) to support

the net (4) is heated with a hot-blade device;
- the net (4) is positioned on the heated step (30);
- the net (4) is cold-pressed, so that the edges of the net penetrates through the hotted material of the step (30).

10. A process for realizing a tray for drying food, said tray having a structure according to claim 7, **characterised by** the following steps:

- molding of the bottom half-frame (106);
- placing the net (4) on said bottom half-frame (106);
- molding of top half-frame (105), to weld on said bottom half frame (106).

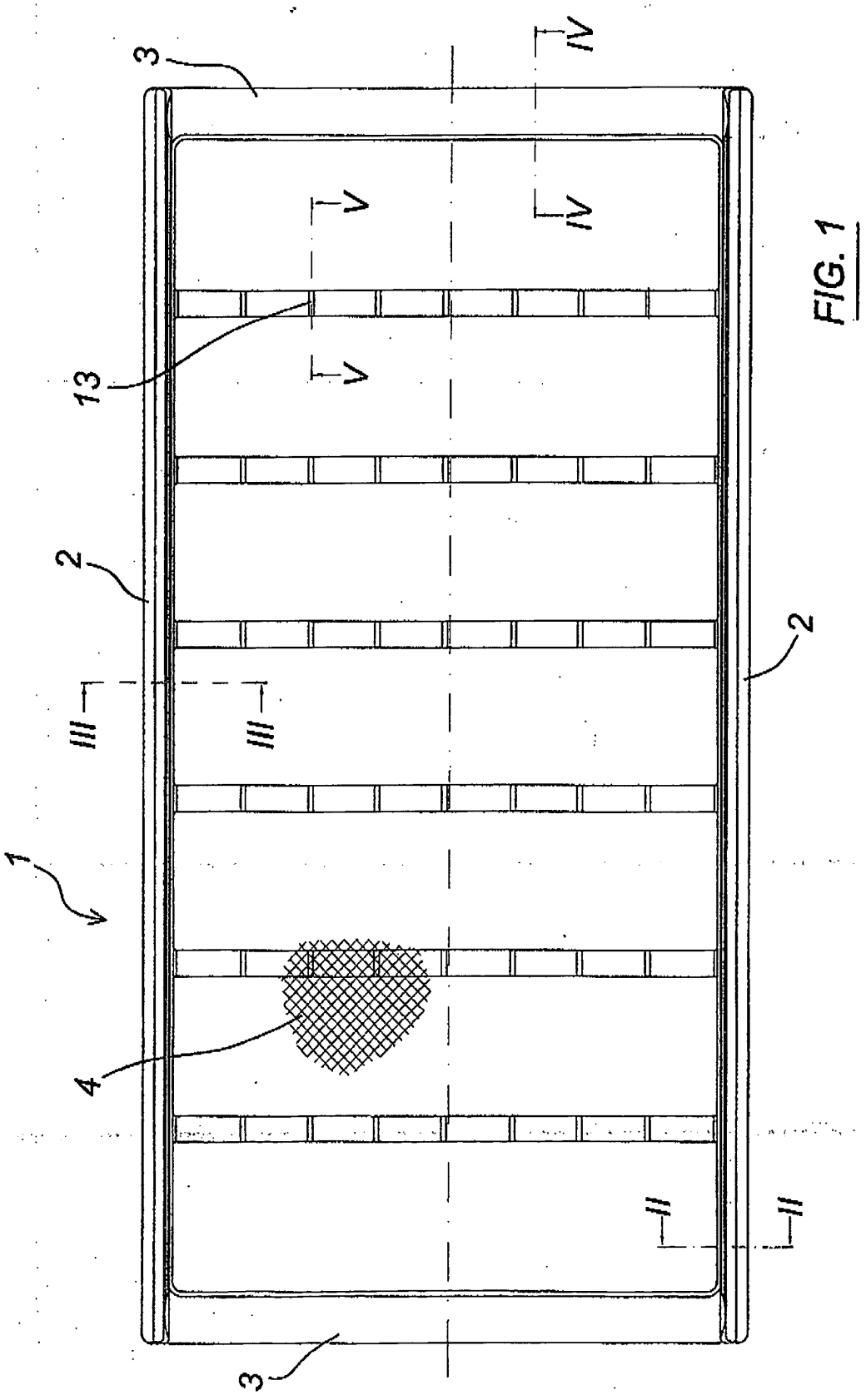

FIG. 1

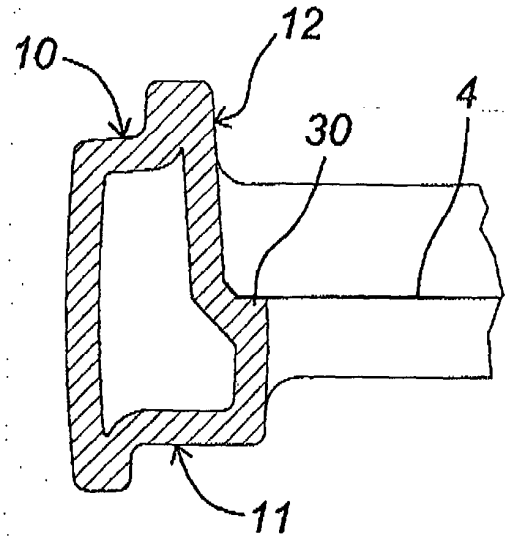

FIG. 2

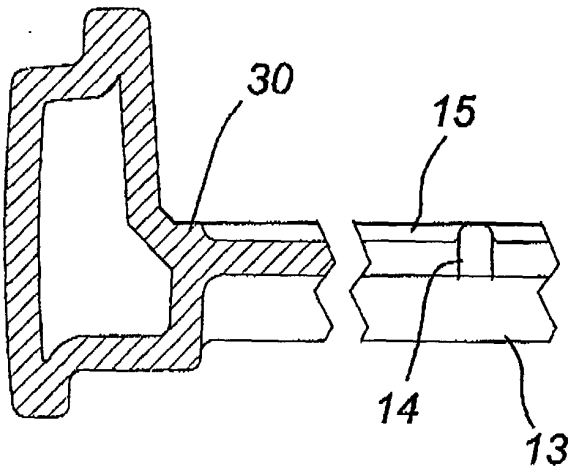

FIG. 3

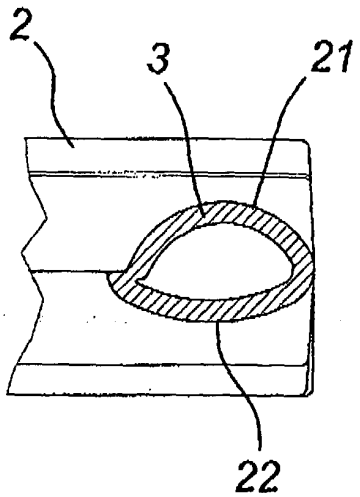

FIG. 4

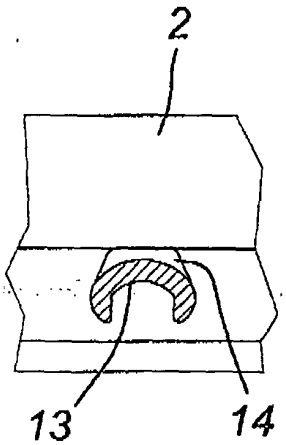

FIG. 5

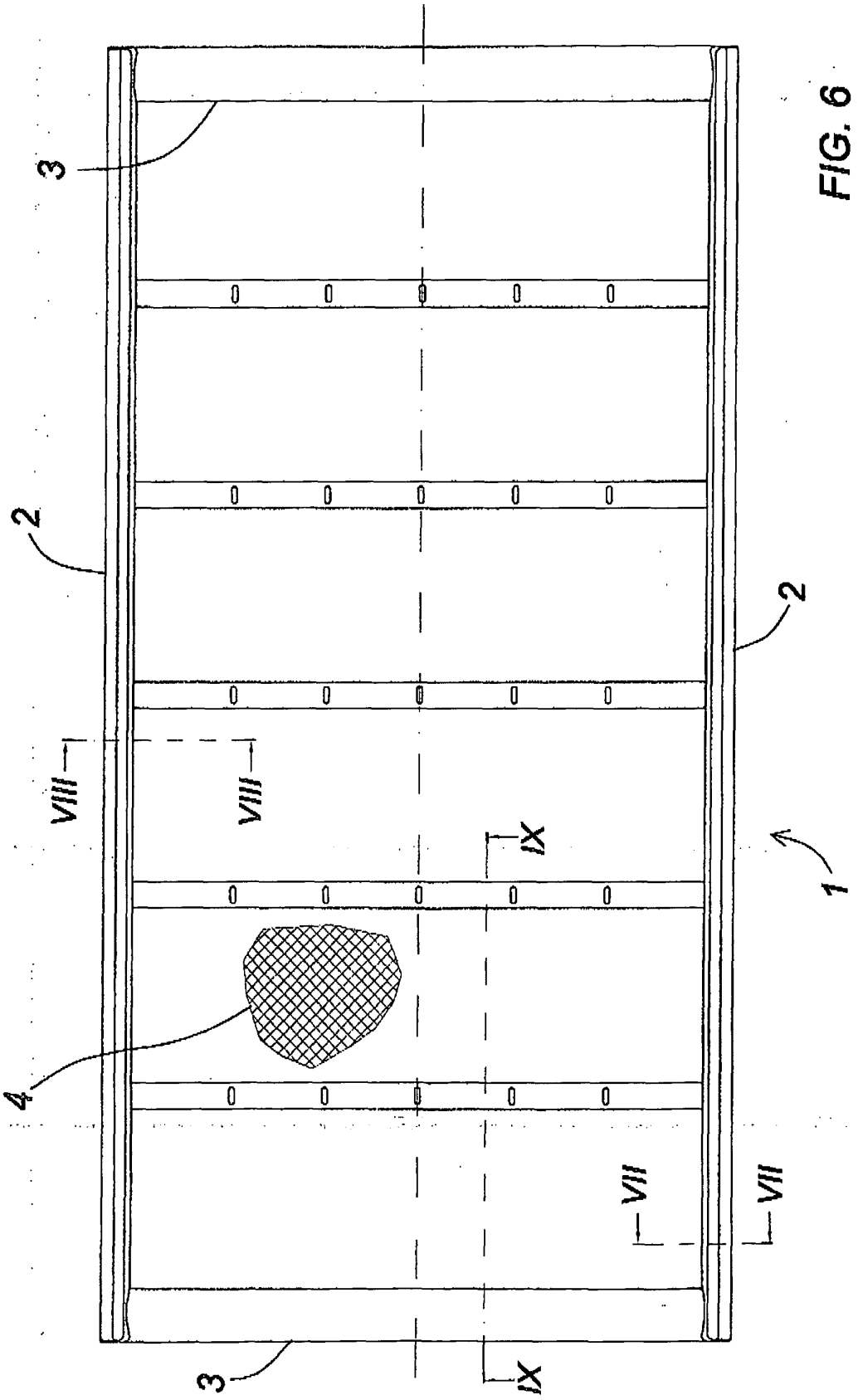

FIG. 6

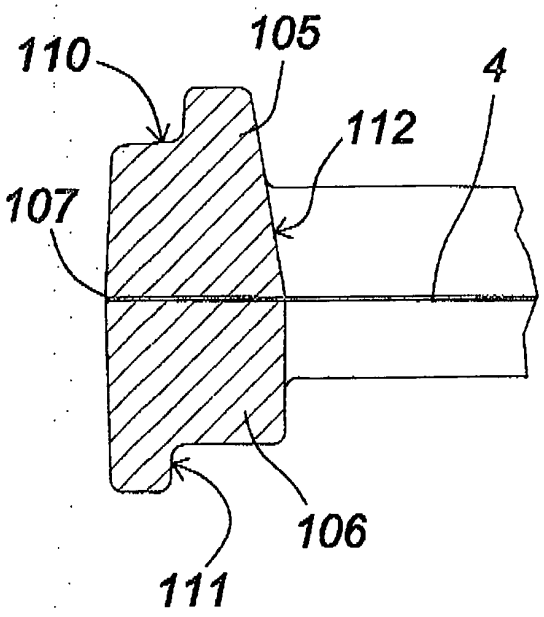

FIG. 7

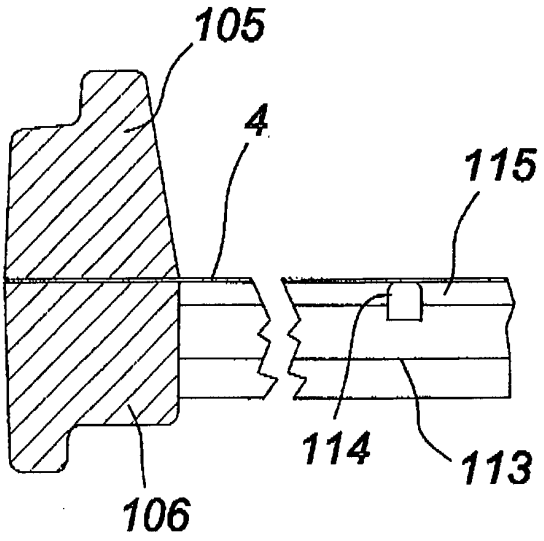

FIG.8

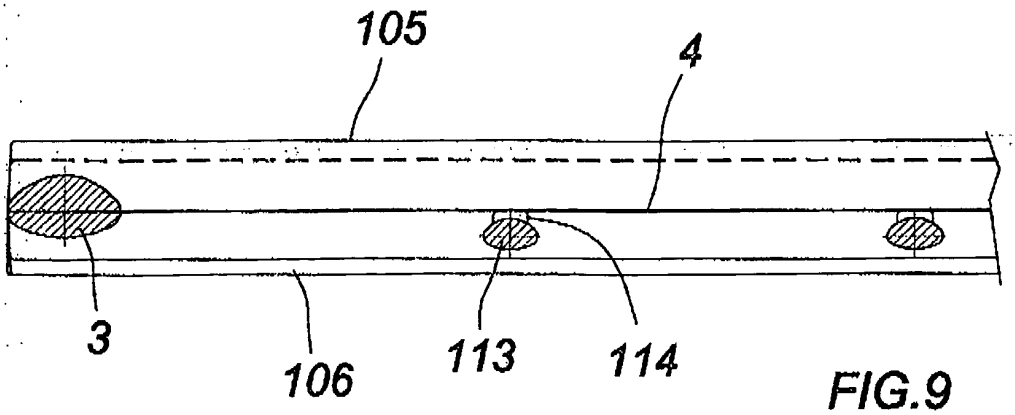

FIG.9

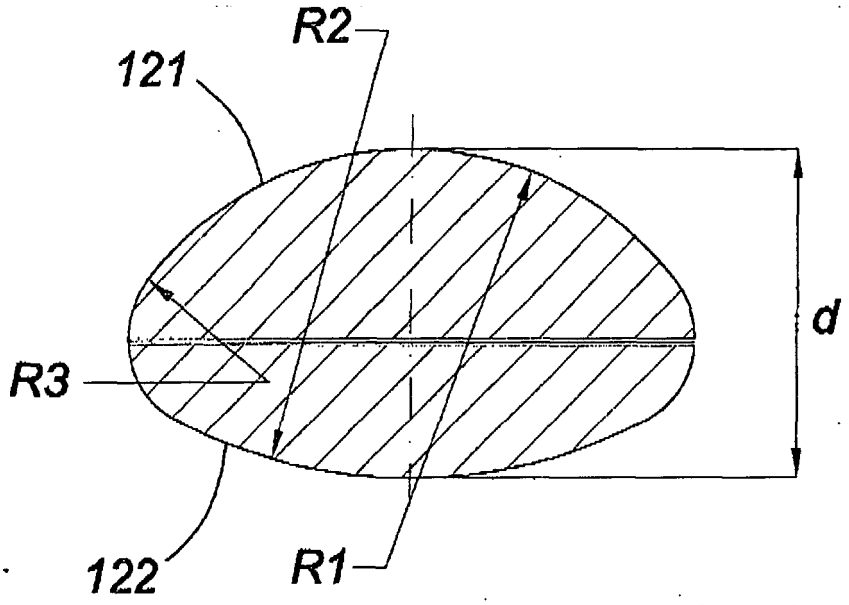

FIG. 10

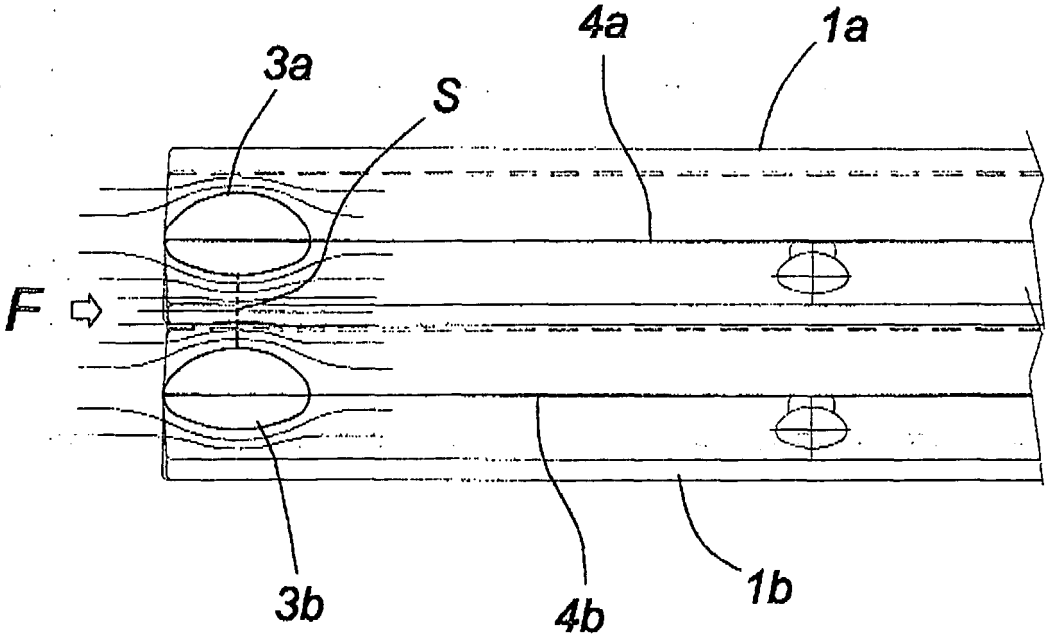

FIG. 11