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(54) **Apparatus for recycling asphalt for production plants of bituminous conglomerate**

Vorrichtung zur Wiederaufbereitung von Asphalt in Herstellungsanlagen von Bitumenkonglomerat

Dispositif de recyclage d'asphalte pour des installations de production de conglomerat de bitume

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(74) Representative: **Paolini, Elena**  
**Ufficio Internazionale Brevetti,**  
**INIP,**  
**Via Ruggi 5**  
**40137 Bologna (IT)**

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(73) Proprietor: **Ghirardelli Plants SRL**  
**44014 Longastrino (Ferrara) (IT)**

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**US-A- 4 143 972**                      **US-A- 4 207 062**  
**US-A- 4 919 538**

(72) Inventor: **Ghirardelli, Giorgio**  
**44014 Longastrino (Ferrara) (IT)**

**EP 1 624 109 B1**

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## Description

[0001] It is known that the apparatuses for recycling asphalt are largely formed of coaxial cylinders that have in their inside two separated chambers: the drying chamber and, in the bigger cylinder, the combustion chamber. The axis of the coaxial cylinders, such as the plant accessorial elements, are angled of some degrees in comparison with the horizontal line to permit to the material flow in working inside the cylinders to move itself in the slope direction. Moreover, the drying chamber is in rotation to favour the heating and the mixing of the inert materials and of the recycling material introduced from the top in the plant. With the words recycling material is meant the materials coming to the demolition of previous wearing courses, introduced inside the bigger cylinder to an upper opening. Moreover the combustion chamber has at its inside a burner placed downstairs of the plant that, in central area, generates a flame so to heat the introduced materials. The heating of the materials till the compound formation downstairs of the plant is necessary to have the fluid vein of the melted inert materials and melted recycled materials. The aggregate of bitumen with the recycled material determines, after to be positioned onto the street in construction and by use of other engines, the new wearing course. The invented apparatus consists of a apparatus for recycling asphalt with a particular orifice plate according to claim 1, separating the combustion chamber to the drying chamber and the other components, able to increase the plant productivity and also to permit the use of bigger quantity of recycled material with consequent decrease of the costs of the actuated new wearing course. The apparatus is so able to use bigger quantity of material to be worked and to have a large adaptability to the necessities of the different asphalt engines. Different plants are known, as for instance the plant described in the patent US-A-4 207 062. Said plant has an orifice plate, to separate the combustion chamber to the drying chamber, with fixing openings to permit the hot gas crossing from the combustion chamber to the drying chamber. Said openings, being fixed onto the orifice plate, do not permit to regulate the oxygen quantity into the combustion chamber and, consequently, to regulate the temperature into the said combustion chamber. The invented apparatus consists of an orifice place 1 according to claim 1 separating the combustion chamber 2 to the drying chamber 3 and placed between these two chambers of any kind of plant 4 to recycle the asphalt with production, at the end, of inert materials and recycled materials mixed for the bituminous conglomerate plants. Said orifice plate 1 equipped, onto the ledging part to the burner flame, of fixing elements 5 able to permit the assembling of one or more affixing structures 6, in truncated cone shape or in shape of nozzle, in shape continuity with the same orifice plate 1 and so to help the slippage of the air flow passing inside. Moreover onto the outside conical part of the orifice plate 1 and of the structures 6 are present ledges 6A with angle of about 45° in

comparison with the longitudinal axis so to direct the flow of the recycled materials and to permit its falling, with the rotation given to other parts connected to the affixing structures 6 and to the orifice plate 1, in parts of the combustion chamber not under the orifice plate 1 and the structure 6. Said structures 6, to be added to the plant on the base of the production necessities, have an opening toward the burner flame that comes to tighten on the base of the number and/or dimension of the elements of the affixing structure 6. The truncate cone structures 6 added to the orifice plate 1 are so to realize a restriction of the air flow placed through the burner and the outlet given to the stack 7. The air flow passes from the drying chamber 3 to the combustion chamber 2 crossing the central opening 8 of the affixing structures 6 and coming to form, in relation to the actuated restriction, a Venturi effect before coming inside the combustion chamber 2. It is to consider that the affixing structures 6 permit to extend the conicity in the requested dimension for bigger quantity of working material also maintaining unchanged the other parts of the plants. Infact, having actuated the central opening 8 more narrow, the air flow inside the plant is accelerated. So coming air more quickly is increased also the oxygen quantity presents in the combustion chamber and the flame, generated to the burner, reaches higher temperatures. The higher temperature inside the combustion chamber permits an use of bigger quantity of recycled material so like an increasing of the plant productivity. The affixing structure 6, connected to the orifice plate 1 by the fixing elements 5, are so provided in numbers and dimensions in relation to the plant productive capacity wanted, considering the increasing of the air flow on the base of the product quantity wanted and the end of the same plant. The orifice plate 1 and the affixing structure or structures 6 are put in rotation such as they are connected with the drying chamber 3 puts in movement by outside motors. Moreover, the orifice plate 1 has on its level border, placed previous the truncate cone ledging structure or ogival one, of openings 9 to permit the air passage at high temperatures from the combustion chamber 2 to the drying chamber 3. Said openings 9, realized boring the structure long the vertical wall 10, have an important rule such as, since in combustion chamber there is a considerable increasing of the temperature with relative increasing of the pressure, said openings 9 permit, through the air flow with opposite direction in comparison with the central one that goes to feed the burner flame, to bring air and smokes with high temperature to the drying chamber. Moreover, said air and said smokes, passing through the openings 9 placed onto the metallic structure of the truncate cone orifice plate 1, heat the same structure brings the same to a high temperature. The recycling material, coming to the inlet hopper 11 placed over the combustion chamber, infact, tends to attach to the outside surface 12 of the orifice plate 1 and to the outside surface of the affixing structures 6 if these parts are not at high temperature. It is to consider that the material coming to the hopper 11

and that falling down for gravity inside the combustion chamber 2, if it comes to attach to the walls of the outside surface 12, generates stoppage and it limits the inlet carrying of the material. The openings 9 so permit to have the orifice plate 1, the elements 10 and 12 and the affixing structures 6 with high temperature in the particular parts so avoiding the adhesion of the worked recycling material. It is to be noted that the hopper 11 is placed in correspondence of the orifice plate 1 so that the ledging part of said orifice plate avoids the direct radiation of the flame onto in inlet material which will determine the material fusion in the inlet hole and so stoppage to the hopper and to the underlying parts. The hopper 11 in this position permits, moreover, to have more time for the drying of the inert materials coming to the chamber 3 and to mix in more homogeneous way the recycled materials with the inert materials. Infact, the hopper disposition in this position permits to better eliminate the humidity in these materials when these are melted to the high temperatures create and to the more time of remaining inside the combustion chamber. Then, complementary, inside the drying chamber 3, i.e. inside the rotating drum put in movement to the motors 13, are present suitable tongues 14 to spread the inert materials which fall down to the cavities 15 placed inside the rotating drum. The drying chamber, infact, rotates around the own axis longitudinally bringing to a fixed distributor the material that comes inside of longitudinal cavities 15 placed in parallel long the own inside surface. At a determined height the contents of said cavities, i.e. the inert materials, fall in the low part of the rotating drum. During the falling the poured material to the cavities 15 meets the tongue 14 that spreads the inert material forming a thin layer of material inside the cylinder forming the drying chamber 3. The material spread in the falling flow from the upper part of the rotating drum to the tongue 14 better holds the hot smokes inside the drying chamber and in the same time the material placed in rotation and poured is heating. Moreover, to facilitate the drying and to eliminate the humidity dangerous to the formation of the bituminous conglomerate and to extend the permanence time inside the apparatus, in the inside part of the combustion chamber, also this in rotation in this part, are placed crowds of tongues 16, perpendicular to the inside surface of the rotating drum and placed with incidence angle long the material flow direction so to slow the flow same. The surface of these tongues that meet the flow is, infact, angulated in such a way to bring again at the beginning of the plant the elements forming the material of new emission and of bigger dimension. Said elements of bigger dimension heavier are pushed in contrary direction to the flow directs to the end of the plant by the surface of the tongues and increase their time of permanence inside the plant. Moreover, the new emission material parts are often those with bigger humidity containment. The function of the tongues 16 is so that to increase the permanence time and, such as those tongues 16 are in projection from the inside surface of the rotating drum, they bring those

parts of new emission material in surface in comparison to the flow material that flows inside of the inner concavities of the cylinders, whereas the material goes on toward the outlet at the end of the plant, from the part of the burner. The invented apparatus is illustrated in a merely indicative and not limiting way in the drawings of sheets 1, 2 and 3. In sheet 1 figure 1 is longitudinal section view of a plant to dry inert materials, to recycle asphalt and to produce with other mixing machineries bituminous conglomerates. In sheet 2 figure 2 is section view of the invented apparatus. Figure 3 is lateral view of the same apparatus. In sheet 3 figure 4 is inside view of the tongues placed into the rotating drum to spread the inert material produced inside the plant. Figure 5 is perspective view of the tongue 14 with cavity 15 carrying the material. The figure 6 is section view showing the tongues 16 angulated in comparison to the material flow coming down to the plant.

### Claims

1. Apparatus for recycling asphalt for production of plants of bituminous conglomerate comprising a drying chamber (3), a combustion chamber (2) and an orifice plate (1) separating said drying chamber (3) and said combustion chamber (2) **characterized in that** one or more affixing structures (6) in truncated cone or nozzle shape are connected fixing elements (5) in shape continuity to said orifice plate (1), to realize a restriction of the air flow from the drying chamber (3) to the combustion chamber (2), so that they form, in relation to the actuated restriction of the air flow, a Venturi effect to the combustion chamber (2) and increase the oxygen quantity present in the combustion chamber (2) thereby increasing the temperature of the burner flame.
2. Apparatus, according to previous claim, **characterized in that** the structures (6) are provided in number and dimension on the base of the plant productive capacity wanted.
3. Apparatus, according to claims 1 or 2, where said orifice plate (1) has openings (9) along its vertical wall (10) to bring air and smoke with high temperature to the drying chamber (3) in order to heat both the structures (6) and the orifice plate (1) thereby avoiding the adhesion of the recycled material onto the surfaces and near the structures (6) and the orifice plate (1).
4. Apparatus, according to the previous claims, **characterized** to have tongues (14) to pour inert materials that fall into cavities (15) placed inside the rotating drum forming the drying chamber (3).
5. Apparatus, according to the previous claims, **char-**

**acterized** to have crowds of tongues (16), perpendicular to the inside surface of the rotating drum and placed with incidence angle long the material flow direction, so to slow the flow of the materials going downward in the plant and to increase the permanence inside the combustion chamber (2).

### Patentansprüche

1. Vorrichtung zur Wiederaufbereitung von Asphalt in Herstellungsanlagen von Bitumenkonglomerat mit einem Trocknungsraum (3), einem Verbrennungsraum (2) und eine Trennwand (1), die den genannten Trocknungsraum (3) und den genannten Verbrennungsraum (2) trennt, **dadurch gekennzeichnet, dass** eine oder mehr zusätzliche kegelstumpfförmigen oder düseförmigen Strukturen (6) gibt, die mit Befestigungselementen (5) in Formstetigkeit zur genannten Trennwand (1) verbunden sind, um eine Luftströmungsverengung aus dem Trocknungsraum (3) nach dem Verbrennungsraum (2) zu realisieren, so dass sie in bezug auf die verwicklichte Luftströmungsverengung einen Venturieffekt im Verbrennungsraum (2) bilden, und die Sauerstoffmenge im Verbrennungsraum erhöhen, so dass sie die Temperatur der Flamme des Brenners erhöhen.
2. Vorrichtung, nach vorigen Anspruch, **dadurch gekennzeichnet dass** die Strukturen (6) an Quantität und Dimension je nach der gewünschten Leistungsfähigkeit der Anlage vorgesehen sind.
3. Vorrichtung, nach den Ansprüchen 1 oder 2, **dadurch gekennzeichnet dass** die genannte Trennwand (1) ihre senkrechte Wand Öffnungen (9) hat, um an hohe Temperatur nach dem Trocknungsraum (3) Luft und Rauche zu tragen, so dass man sowohl die Strukturen (6) als die Trennwand erwärmen kann, und dafür die Adhäsion der wiederaufbereiteten Stoff auf die Fläche und in der Nähe der Strukturen (6) und der Trennwand (1) verhindert wird.
4. Vorrichtung, nach den vorigen Ansprüchen, **dadurch gekennzeichnet dass** in dem es kleine Flügel (14) gibt, um den Inertstoff auszustreuen, und dieser Stoff fällt in die Höhlungen (15), die innerhalb der drohenden Trommel der Trocknungsraum (3) liegen.
5. Vorrichtung, nach den vorigen Ansprüchen, **dadurch gekennzeichnet dass** es Flügelkronen (16) gibt, die senkrecht auf die innere Fläche der drohenden Trommel sind, und die im Anstellwinkel die Richtung der Stoffströmung entlang liegen, so dass sie die in die Anlage untersteigende Stoffströmung verlangsamen und das Anhalten innerhalb der Verbrennungsraum (2) erhöhen.

### Revendications

1. Dispositif de recyclage d'asphalte pour des installations de production de conglomerat de bitume incluant une chambre de séchage (3), une chambre de combustion (2) et un diaphragme (1) séparant dite chambre de séchage (3) et dite chambre de combustion (2), **caractérisée par le fait que** une ou plusieurs structures additionnelles (6), à forme tronconique ou de gicleur, sont liées avec des éléments de fixation (5) dont la forme s'adapte à dit diaphragme (1), réalisant ainsi un rétrécissement du flux de l'air de la chambre de séchage (3) à la chambre de combustion (2), ainsi qu'elle forment, en rapport au rétrécissement développé par le flux de l'air, un effet Venturi à la chambre de combustion (2) et augmentent la quantité d'oxygène présente dans la chambre de combustion afin de élever la température de la flamme due brûleur.
2. Dispositif, selon la revendication précédente, **caractérisée par le fait que** le numero et les dimensions des structures (6) sont en fonction de la capacité productive de l'installation.
3. Dispositif, selon revendications 1 ou 2, où dit diaphragme (1) présente des percées (9) le long de sa paroi verticale (10) pour apporter l'eau et les fumées déjà à haute température à la chambre de séchage (3) de manière à rechauffer soit les structures (6) soit le diaphragme (1) évitant ainsi l'adhésion de la matière recyclée sur les surfaces et près des structures (6) et du diaphragme (1).
4. Dispositif, selon revendications précédente, **caractérisée par le fait que** il possède de petites ailes (14) pour éparpiller les matériaux inertes qui tombent dans les cavités (15) se trouvant à l'intérieur du tambour roulant qui forme la chambre de séchage (3).
5. Dispositif, selon revendications précédente, **caractérisée par le fait que** il possède des couronnes de petites ailes (16) perpendiculaires aux surfaces intérieures du tambour roulant et disposées avec leur angle d'incidence le long du flux de matériel, retardant ainsi le flux du matériel descendant à val dans l'installation et augmentant ainsi la permanence à l'intérieur de la chambre de combustion (2).

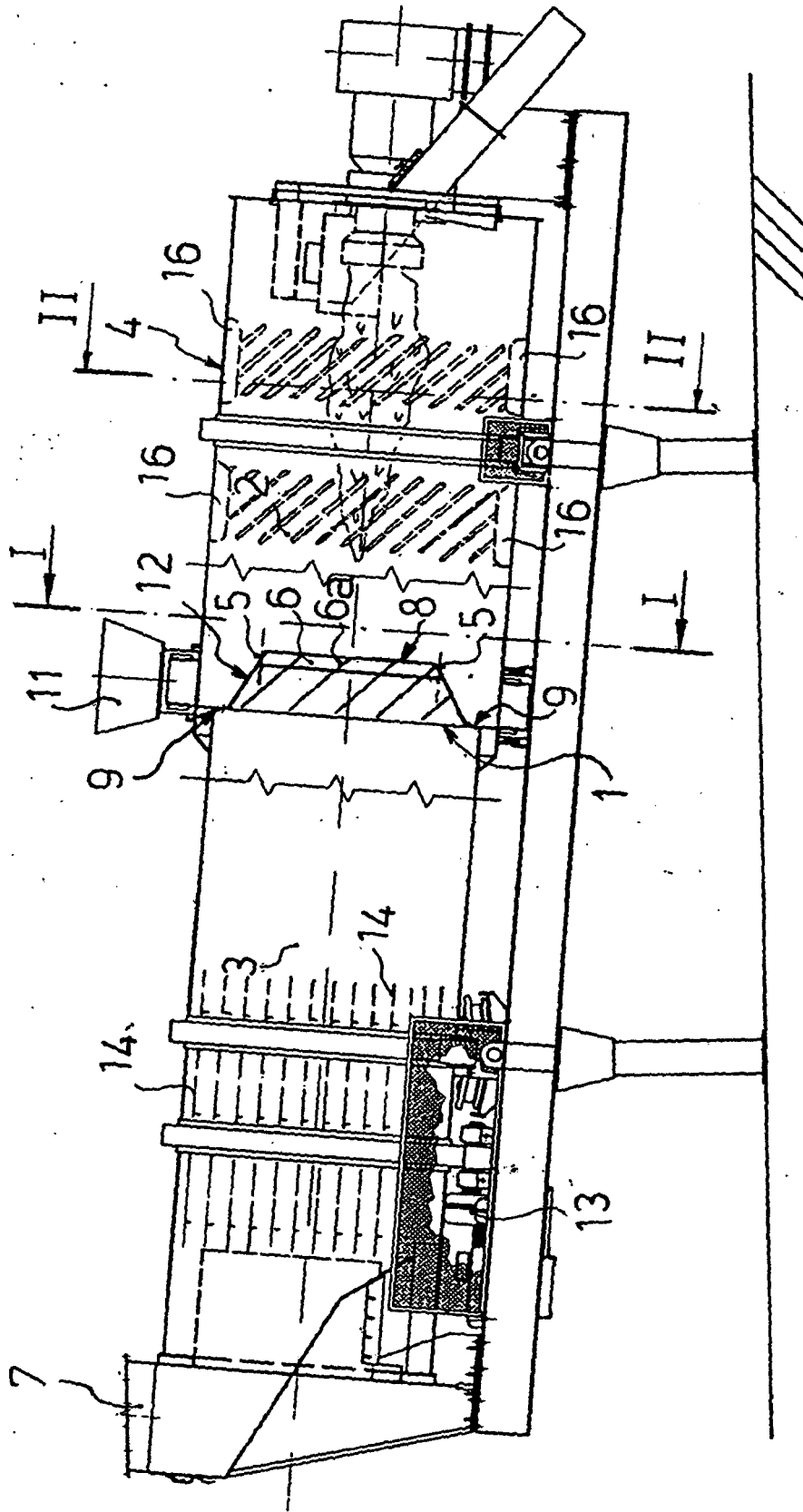


FIG. 1

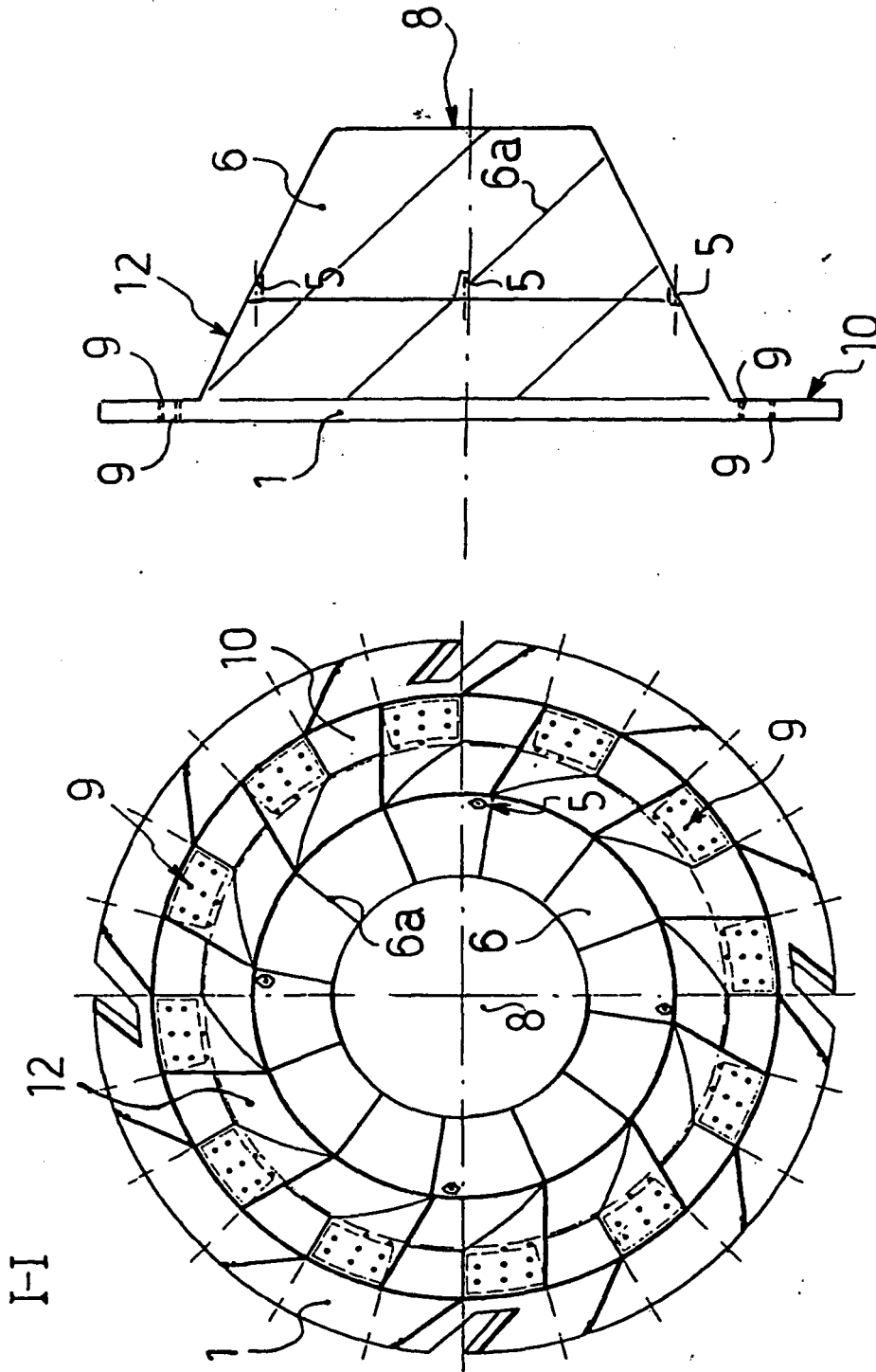


FIG. 2

FIG. 3

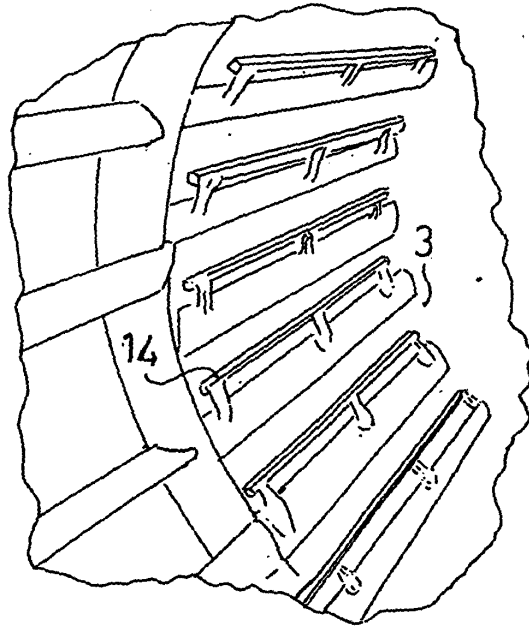


FIG. 4

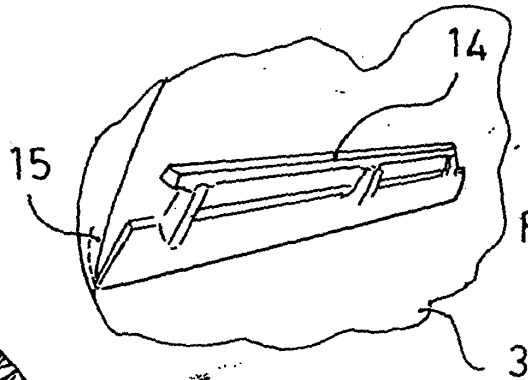


FIG. 5

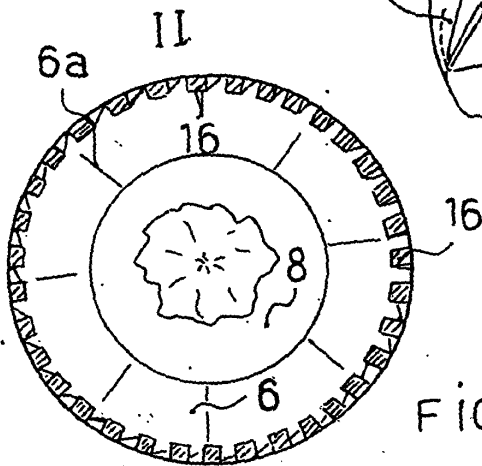


FIG. 6

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 4207062 A [0001]