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(54) **Separator unit for liquid bath vacuum cleaners**

Trennvorrichtung für Staubsauger mit Flüssigkeitsbad

Séparateur pour aspirateur à bain de liquide

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(56) References cited:
WO-A-92/03210

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Description

FIELD OF THE INVENTION

[0001] This invention concerns a separator unit for liquid bath vacuum cleaners as set forth in the main claim.
[0002] The separator unit is employed in liquid bath vacuum cleaners to separate particulates of dust and dirt from the ingested air.

BACKGROUND OF THE INVENTION

[0003] The state of the art includes liquid bath vacuum cleaners employed for cleaning, which comprise a box-like structure housing an intake assembly, a system with an air chamber, a rotary separator and a tank, open at the upper part, containing liquid, normally water.
[0004] The box-like structure includes an inlet aperture which communicates with the tank; the intake conduit engages with the said aperture.
[0005] The inlet aperture is normally made on the tank at a height above the level of the liquid contained therein and is orientated towards the liquid.
[0006] The separator is arranged facing above the tank and assembled on the drive shaft of the intake assembly; it substantially consists of a hollow body, generally shaped like a truncated cone, and includes at the sides longitudinal slits inclined according to the direction of rotation.
[0007] In this type of vacuum cleaner the particulates of dirt and dust which are picked up through the intake conduit are taken into the tank and most of them mix with the liquid and are retained therein.
[0008] On the contrary, the particulates of dirt and dust which stray in the tank, together with droplets of liquid, are sucked up by the vacuum created by the intake assembly and enter inside the hollow body of the rotary separator through the longitudinal slits thereof.
[0009] The centrifugal force deriving from the rotation of the separator generates a phenomenon of coalescence between the particulates of dirt and dust and the drops of water which are forced towards the outside, separating from the air which, on the contrary, is drawn upwards, is impelled into the air chamber system and discharged into the outside environment through apertures made for this purpose.
[0010] The centrifugal force also causes the agglomerated particulates of dirt, dust and liquid to be discharged from the separator through the longitudinal slits; the particulates then fall into the tank of liquid due to their own weight.
[0011] However, some of the particulates remain inside the hollow body of the separator and are either deposited on the walls thereof or they filter into the coupling zone between the separator and the drive shaft, which causes an encrustation of dirt to form.
[0012] This situation entails that the vacuum cleaner needs frequent maintenance and, in the long term, it can lead to a reduction in the efficiency of the separator or damage to the intake assembly.
[0013] Document WO-A-9203210 discloses a separator unit for use in connection with a liquid bath type vacuum cleaner system wherein the separator unit includes an annular, cup-like housing shaped like a truncated cone and able to axially rotate about onto a central drive shaft for generating a centrifugal force to be applied to intake air therein. A plurality of slots are provided on the housing for allowing dust and dirt particulates entrained in the intake air and liquid particulates from a liquid bath to be drawn into an interior area of the housing and coalesce the coalesced particulates are subjected to centrifugal force and thereby separated from the intake air. This known separator unit comprises also a disk shaped supporting element axially holed and keyed onto the central drive shaft. The supporting element is coupled with the housing by means of a peripheral edge and includes a plurality of radial apertures or vanes for the passage of the ingested air. Slots allow the coalesced particulates to be forcibly expelled from the interior area of the housing as they are forced radially outwardly by the centrifugal force generated by rapid, axial rotation of the housing.
[0014] The present Applicant has designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0015] The invention is set forth and characterised in the main claim, while the dependent claims describe variants of the idea of the main embodiment.
[0016] The purpose of the invention is to provide a rotary separator assembly for liquid bath vacuum cleaners which will give a better discharge of the agglomerated particulates of liquid, dirt and dust once these particulates have been separated from the air.
[0017] The separator assembly according to the invention comprises a hollow body which is constrained to the drive shaft by means of a disk-shaped and axially holed supporting element.
[0018] The supporting element is keyed onto the drive shaft and includes a peripheral edge which couples with the upper edge of the hollow body.
[0019] The supporting element also includes a plurality of apertures arranged radially which allow the air which is to be discharged to pass from the hollow body of the separator to the air chamber system.
[0020] The invention is characterised in that the disk-shaped supporting element is provided with a tooth able to be coupled by contact with a shape made on said upper edge of the hollow body, in that said disk-shaped supporting element comprises a plurality of discharge slits made radially on the portion of said peripheral edge which defines said tooth, in that said discharge slits are arranged in correspondence with said radial apertures

to discharge the residue particulates of dirt, dust and liquid from inside said separator unit, in that the inner side of said discharge slits is connected with the corresponding radial aperture, in that the discharge slits are open at the upper part between the upper edge and the disk-shaped supporting element, in that said longitudinal slits are defined by ribs having a discontinuous longitudinal development comprising an upper segment and a lower segment separated by an intermediate step-like portion facing towards the cavity of the hollow body, in that said intermediate step-like portion defines a first lower intake zone with a reduced diameter and a second upper zone, with a wider diameter, for the discharge of the liquid mixed with dust and dirt, and in that between the upper segment and the lower segment of the rib there is a stiffening ring.

[0021] In the separator according to the invention the rotation action causes the particulates of dust and dirt to coalesce with the little drops of liquid which has been ingested.

[0022] These particulates, agglomerated with the liquid, are separated from the air and thrust towards the outside of the hollow body of the separator assembly due to the effect of the centrifugal force, while the "filtered" air is forced inside the air chamber system through the radial apertures of the supporting element and then discharged into the outer environment.

[0023] The agglomerated particulates of dirt, dust and liquid which have not been expelled and which tend to rise up along the walls of the hollow body, are instead discharged outside the separator assembly through the discharge slits, again due to the effect of the centrifugal force generated by the rotation of the separator assembly itself.

[0024] This gives a better functioning of the separator assembly and substantially prevents the formation of encrustations and deposits of the agglomerated particulates which may lead to break-downs or malfunctions of the vacuum cleaner.

[0025] Moreover, there is a reduced need to maintain and clean the vacuum cleaner and a reduced risk of wear and deterioration of the functional components thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The attached Figures are given as a non-restrictive example and show a preferential embodiment of the invention as follows:

Fig. 1 is a section drawing of the separator assembly according to the invention;
Fig. 2 is a front view of the hollow body of the separator shown in Fig. 1;
Fig. 3 shows a view from "D" of Fig. 2;
Fig. 4 shows a section from "A" to "A" of Fig. 3;
Fig. 5 shows a view from above of the supporting element of the separator assembly of Fig. 1;
Fig. 6a shows a section from "B" to "B" of Fig. 5;
Fig. 6b shows a section from "C" to "C" of Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0027] The separator assembly 10 according to the invention for liquid bath vacuum cleaners is shown in section in Fig. 1.

[0028] The separator assembly 10 is assembled on the drive shaft 11 of the intake assembly of the vacuum cleaner and faces above a tank to contain the liquid (not shown here).

[0029] The separator assembly 10 consists of a hollow body 12 shaped like a truncated cone and of a mating disk-shaped supporting element 13 by means of which the hollow body 12 is constrained to the drive shaft 11.

[0030] In this case, the hollow body 12 is constrained to the drive shaft 11 at the upper part by means of the supporting element 13 and at the lower part by means of a screw-type attachment element 14.

[0031] To be more exact, the supporting element 13 is keyed onto the drive shaft 11, in this case by means of a coupling bush 16, and includes a peripheral edge 17 comprising a tooth 17a which can be coupled through contact with a shaping 18a made on the upper edge 18 of the hollow body 12 (Fig. 1).

[0032] In correspondence with the lower face 19, the hollow body 12 includes an axial hole 20 inside which the drive shaft 11 is inserted.

[0033] In its end portion which emerges from the axial hole 20, the drive shaft 11 includes a thread 15 onto which the screw-type attachment element 14 is anchored, in order to complete the coupling of the drive shaft 11 and the hollow body 12.

[0034] The longitudinal slits 21 of the hollow body 12, made along the lateral surface of the latter, are defined in this case by ribs 22 which develop lengthwise in two non-aligned segments 22a and 22b, defining an intermediate step-like portion facing towards the cavity of the hollow body 12.

[0035] The step-like portion defines a first intake zone with a reduced diameter and a second zone, with a wider diameter, for the discharge of the liquid mixed with dust and dirt.

[0036] The hollow body 12 also includes a stiffening ring 23 arranged in an inner position with respect to the upper segment 22a and substantially above the lower segment 22b.

[0037] The supporting element 13 includes a plurality of radial apertures 24 in this case shaped like a rounded trapezoid.

[0038] The radial apertures 24 are separated by walls 25 equipped with stiffening fins 26.

[0039] On the portion of peripheral edge 17 cooperating with the tooth 17a, there are also a plurality of discharge slits 27, each of which connects a relative radial

aperture 24 with the outside.

[0040] In this case, the discharge slits 27 have lateral walls 27a which connect with the relative radial apertures 24 so as to define a lead-in mouth to encourage a better discharge of the residual particulates and drops.

[0041] According to another embodiment, the discharge slits 27 are open at the upper part.

[0042] The discharge slits 27 are arranged between the upper edge 18 of the hollow body 12 and the lower wall 28a of the air chamber system 28 of the vacuum cleaner (Fig. 1).

[0043] When the vacuum cleaner is working, the flow of air generated by the intake assembly passes through the separator assembly 10 taking with it, inside the hollow body 12 of the separator, the particulates of dust and dirt straying inside the underlying tank containing liquid, and small drops of the liquid itself.

[0044] These particulates and the small drops of liquid enter inside the hollow body 12 mainly through the lower portion of the longitudinal slits 21 and, due to the effect of the centrifugal force, coalesce and separate from the air at the same time.

[0045] Moreover, the centrifugal force itself causes them to be expelled from the hollow body 12 through the longitudinal slits 21, particularly through the upper portion thereof.

[0046] The air which has been purified of these particulates of dirt and dust and the drops of liquid is on the contrary sucked upwards and delivered to the air chamber system 28, to be discharged into the outer environment, passing through the radial apertures 24 of the supporting element 13.

[0047] The residual particulates of dirt and dust together with the drops of liquid which have not been expelled, due to the combined effect of the centrifugal force and the vacuum generated by the intake assembly, tend to rise up along the ribs 22 and then through the walls of the radial apertures 24; then they are discharged though the discharge slits 27 and fall downwards and substantially into the underlying liquid.

Claims

1. Separator unit for liquid bath vacuum cleaners employed to separate from the ingested air the particulates of dirt and/or dust entrained with drops of water, the separator unit comprising at least a hollow body shaped like a truncated cone to be assembled on the drive shaft (11) of the intake assembly of the vacuum cleaner, the hollow body including laterally a plurality of longitudinal slits (21) to discharge the ingested particulates of dirt/dust and/or drops of liquid and a disk-shaped supporting element (13) axially holed to be keyed onto the drive shaft (11), and provided with a peripheral edge (17) for being coupled with the upper edge (18) of the hollow body (12), wherein said disk-shaped supporting element (13) includes a plurality of radial apertures (24) for the passage of the ingested air, **characterised in that** said disk-shaped supporting element (13) is provided with a tooth (17a) able to be coupled by contact with a shape (18a) made on said upper edge (18) of the hollow body (12), **in that** said disk-shaped supporting element (13) comprises a plurality of discharge slits (27) made radially on the portion of said peripheral edge (17) which defines said tooth (17a), **in that** said discharge slits (27) are arranged in correspondence with said radial apertures (24) to discharge the residue particulates of dirt, dust and liquid from inside said separator unit, **in that** the inner side of said discharge slits (27) is connected with the corresponding radial aperture (24), **in that** the discharge slits (27) are open at the upper part between the upper edge (18) and the disk-shaped supporting element (13), **in that** said longitudinal slits (21) are defined by ribs (22) having a discontinuous longitudinal development comprising an upper segment (22a) and a lower segment (22b) separated by an intermediate step-like portion facing towards the cavity of the hollow body (12), **in that** said intermediate step-like portion defines a first lower intake zone with a reduced diameter and a second upper zone, with a wider diameter, for the discharge of the liquid mixed with dust and dirt, and **in that** between the upper segment (22a) and the lower segment (22b) of the rib (22) there is a stiffening ring (23).

Patentansprüche

1. Abscheidereinheit für Flüssigkeitsbad-Staubsauger, die zum Trennen der Schmutz- und/oder Staubpartikel, die mit Wassertropfen mitgerissen werden, von der angesaugten Luft verwendet wird, wobei die Abscheidereinheit mindestens einen hohlen Körper, der wie ein kegelstumpfartiger Konus geformt ist, der an die Antriebswelle (11) der Einlasseinheit des Staubsaugers angebaut werden soll, wobei der hohle Körper seitlich eine Mehrzahl von Längsschlitzen (21), um die angesaugten Schmutz-/Staubpartikel und/oder Flüssigkeitstropfen abzugeben, und ein scheibenförmiges Trägerelement (13), das eine axiale Öffnung aufweist, um an der Antriebswelle (11) festgekeilt zu werden, aufweist und mit einem peripheren Rand (17) versehen ist, um mit dem oberen Rand (18) des hohlen Körpers (12) gekuppelt zu werden, wobei das scheibenförmige Trägerelement (13) eine Mehrzahl radialer Öffnungen (24) zum Durchlassen der angesaugten Luft umfasst, **dadurch gekennzeichnet, dass** das scheibenförmige Trägerelement (13) mit einem Zahn (17a) versehen ist, der durch Kontakt mit einer Form (18a) kuppelbar ist, die an dem oberen Rand (18) des hohlen Körpers (12) vorgesehen

ist, dass das scheibenförmige Trägerelement (13) eine Mehrzahl von Abgabeschlitzen (27) aufweist, die an dem Abschnitt des peripheren Rands (17), der den Zahn (17a) begrenzt, radial vorgesehen sind, dass die Abgabeschlitze (27) entsprechend den radialen Öffnungen (24) angeordnet sind, um die Restpartikel aus Schmutz, Staub und Flüssigkeit aus dem Inneren der Abscheidereinheit abzugeben, dass die Innenseite der Abgabeschlitze (27) mit der entsprechenden radialen Öffnung (24) verbunden ist, dass die Abgabeschlitze (27) im oberen Teil zwischen dem oberen Rand (18) und dem scheibenförmigen Trägerelement (13) offen sind, dass die Längsschlitze (21) durch Rippen (22) begrenzt sind, die einen diskontinuierlichen Längsverlauf mit einem oberen Segment (22a) und einem unteren Segment (22b) besitzen, die durch einen stufenartigen Zwischenabschnitt getrennt sind, der zum Hohlraum des hohlen Körpers (12) gewandt ist, dass der stufenartige Zwischenabschnitt eine erste untere Einlasszone mit einem reduzierten Durchmesser und eine zweite obere Zone mit einem größeren Durchmesser zum Abgeben der Flüssigkeit gemischt mit Staub und Schmutz begrenzt, und dass sich zwischen dem oberen Segment (22a) und dem unteren Segment (22b) der Rippe (22) ein Versteifungsring (23) befindet.

Revendications

1. Unité formant séparateur pour aspirateurs à bain de liquide utilisée pour séparer de l'air absorbé les particules de salissures et/ou poussière entraînées avec des gouttes d'eau, l'unité formant séparateur comprenant au moins un corps creux façonné comme un cône tronqué à assembler sur l'arbre de commande (11) de l'ensemble d'admission de l'aspirateur, le corps creux comprenant latéralement une pluralité de fentes longitudinales (21) pour évacuer les particules absorbées de salissure/poussière et/ou les gouttes de liquide, et un élément de support en forme de disque (13) percé dans le sens axial à fixer sur l'arbre de commande (11) et pourvu d'une arête périphérique (17) pour être couplé avec l'arête supérieure (18) du corps creux (12), dans laquelle ledit élément de support en forme de disque (13) comprend une pluralité d'ouvertures radiales (24) pour le passage de l'air absorbé, **caractérisée en ce que** ledit élément de support en forme de disque (13) est pourvu d'une dent (17a) capable d'être couplée par contact avec une forme (18a) créée sur ladite arête supérieure (18) du corps creux (12), **en ce que** ledit élément de support en forme de disque (13) comprend une pluralité de fentes d'évacuation (27) créées de manière radiale sur la partie de ladite arête périphérique (17) qui définit ladite dent (17a), **en ce que** lesdites fentes d'évacuation (27) sont agencées en correspondance avec lesdites ouvertures radiales (24) pour évacuer les particules résiduelles de salissure, poussière et liquide depuis l'intérieur de ladite unité formant séparateur, **en ce que** le côté intérieur desdites fentes d'évacuation (27) est raccordé à l'ouverture radiale correspondante (24), **en ce que** lesdites fentes d'évacuation (27) sont ouvertes au niveau de la partie supérieure entre l'arête supérieure (18) et l'élément de support en forme de disque (13), **en ce que** lesdites fentes longitudinales (21) sont définies par des nervures (22) ayant un développement longitudinal discontinu comprenant un segment supérieur (22a) et un segment inférieur (22b) séparé par une partie de type étage intermédiaire faisant face vers la cavité du corps creux (12), **en ce que** ladite partie de type étage intermédiaire définit une première zone d'admission inférieure avec un diamètre réduit et une seconde zone supérieure, avec un diamètre plus large, pour l'évacuation du liquide mélangé à la poussière et la salissure, et **en ce que** entre le segment supérieur (22a) et le segment inférieur (22b) de la nervure (22) il existe une bague de renforcement (23).

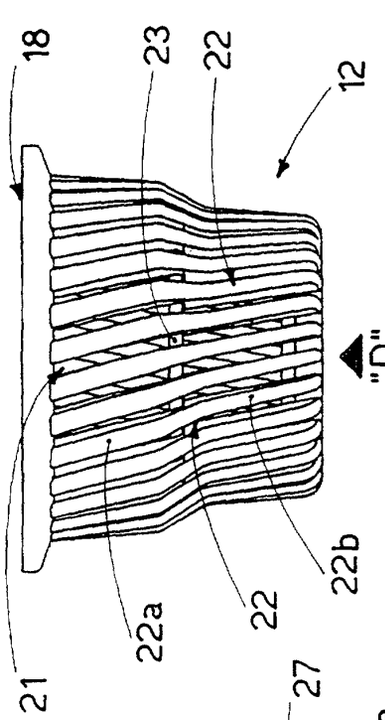


fig.2

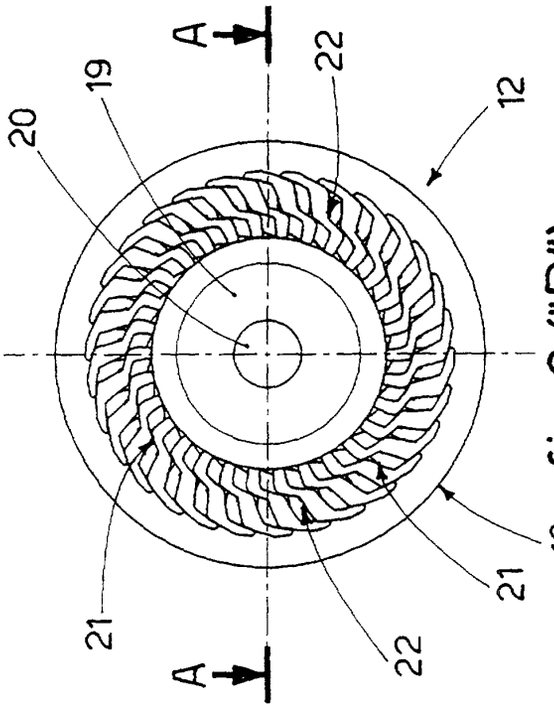


fig.3 ("D")

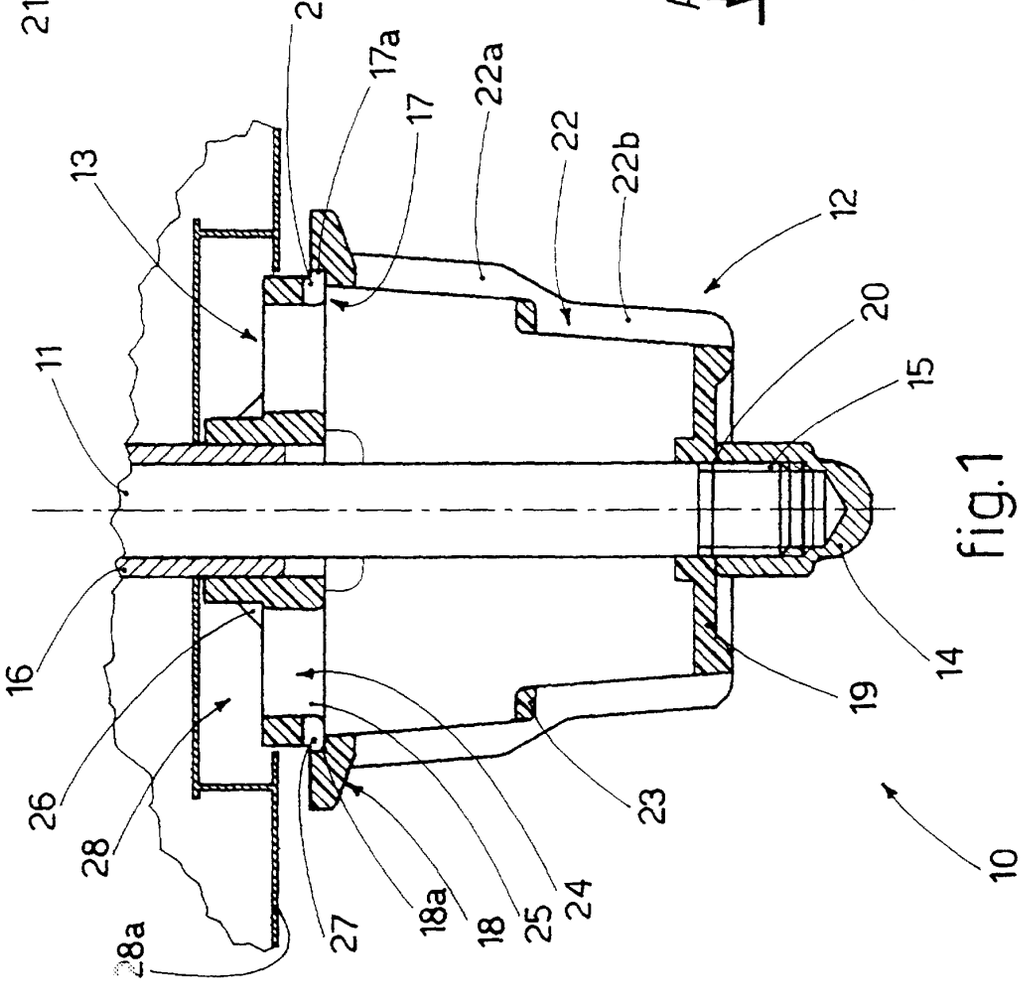


fig.1

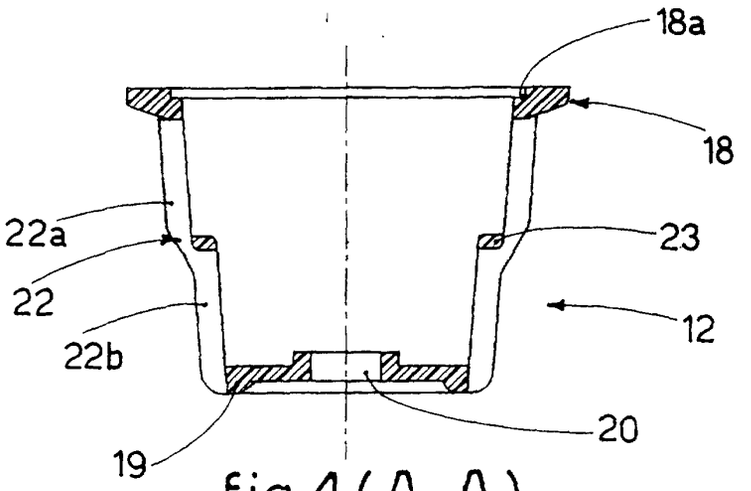


fig.4 (A-A)

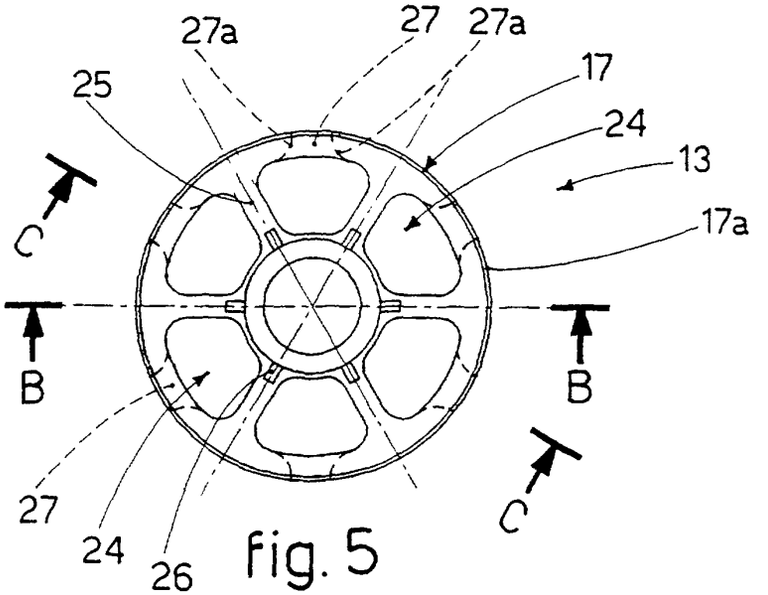


fig. 5

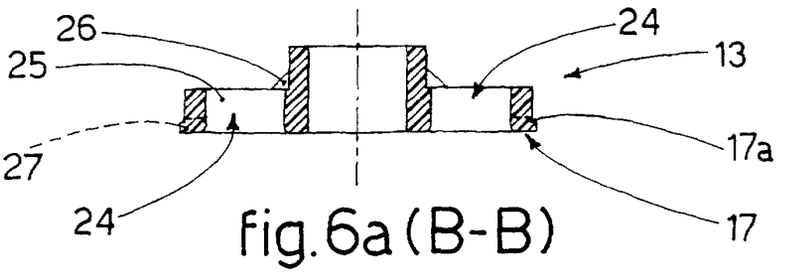


fig.6a (B-B)

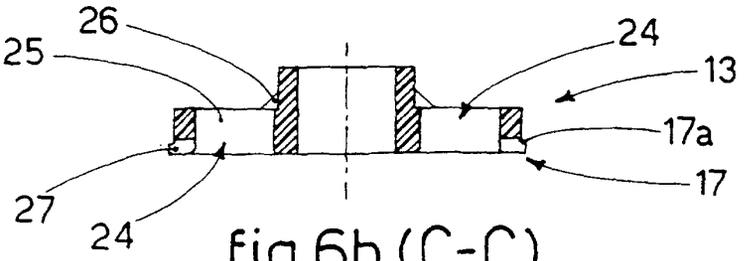


fig.6b (C-C)