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

(11) **EP 3 144 599 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.11.2020 Bulletin 2020/45

(51) Int Cl.:
F24F 13/26 *(2006.01)* ***F24F 7/06*** *(2006.01)*
F24F 13/06 *(2006.01)* ***F24F 13/02*** *(2006.01)*

(21) Application number: **16187554.7**

(22) Date of filing: **07.09.2016**

(54) DUCT SECTION FOR AN AIR MOVEMENT DUCT

LEITUNGSABSCHNITT FÜR EINE LUFTBEWEGUNGSLEITUNG

SECTION DE CONDUIT DESTINÉE À UN CONDUIT DE CIRCULATION D'AIR

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **10.09.2015 GB 201516029**

(43) Date of publication of application:
22.03.2017 Bulletin 2017/12

(73) Proprietor: **Flakt Woods Limited**
Colchester
Essex CO4 5ZD (GB)

(72) Inventor: **Kinghorn, Iain**
Essex, CO4 5ZD (GB)

(74) Representative: **Moore, Derek**
Jensen & Son
366-368 Old Street
London EC1V 9LT (GB)

(56) References cited:
DE-A1-102006 030 662
US-A- 3 981 326
US-A- 4 191 098
US-A- 4 255 176
US-A1- 2012 292 407

EP 3 144 599 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a duct section for an air movement duct for apparatus for ventilating, heating, air-conditioning and/or cooling a space.

[0002] The invention seeks to provide improvements in the efficiency of the air movement, particularly, but not exclusively when it is required to deflect the path of the air movement.

[0003] US Patent No.4255176 discloses an arrangement in which to flows of air are combined into one duct and at the outlet of the duct provides a plurality of curved louvreswhich are pivotally mounted at the outlet ends of the air duct to direct the mixed air in any desired direction but no indication is provided of how the louvres are pivoted and whether they are connected together or not. They are designed essentially to dissipate the outlet air from the duct system. The present invention seeks to provide a ducted flow system in which the flow of the air is guided in a controlled manner.

[0004] According to the present invention there is provided a duct section for an air movement duct, comprising a duct inlet section for a fan driven primary air flow, the duct section further having a peripheral air inlet through which a secondary air flow is drawn into the duct section by entrainment by the passing primary air flow to form a combined air flow of both the primary and the secondary air flows, a nozzle comprising a guide vane arrangement being located downstream of the peripheral air inlet so as to be impinged by and to direct the combined air flows, wherein the guide vane arrangement of the nozzle comprises a plurality of guide vanes in spaced parallel relationship and extending transversely across the duct section, wherein the guide vanes are elongate and arranged to be pivotable about their longitudinal dimension transverse to the direction of the air movement whilst remaining in the parallel relationship, the nozzle being pivotable about an axis substantially aligned with the periphery of the duct section to incline the vanes at an angle to the flow direction of the combined air flows to deflect and guide the airflows.

[0005] Preferably, the nozzle comprises a further part of the duct section spaced from the duct inlet section to form the peripheral air inlet therebetween.

[0006] Alternatively, the peripheral air inlet comprises a slot or plurality of slots extending around substantially the entire periphery of the duct section in a plane normal to the direction of the primary air flow.

[0007] In a preferred arrangement the nozzle is pivotable by up to 20° from the axis of the duct section, and preferably up to 10°.

[0008] In a preferred embodiment, the periphery of the inlet side of the nozzle is profiled, in cross-section, to provide a curved inlet edge to provide a smooth transition of the internal surface of the duct section for the air flow from the primary duct section through the guide vanes irrespective of the angular displacement of the nozzle.

[0009] A preferred embodiment of the present invention is shown in the accompanying drawings in which:-

Figure 1 shows a schematic cross-sectional view of a duct section with a guide nozzle inclined at an angle to the axis of a primary part of the duct section and hence the air flow passing through, to deflect the air flow,

Figure 2 illustrates the duct section of figure 1 in which the nozzle axis is correctional with that of the primary duct section,

Figure 3 shows a schematic part sectional perspective view of the duct section in which the guide vanes of the nozzle have been omitted in the interests of clarity, and

Figure 4 is a schematic illustration using bubbles indicative of the air flow to indicate the air flow through the duct section and the nozzle.

[0010] Referring now to Figure 1 there is shown a schematic cross-sectional view of a duct section 1 which consists of an duct inlet section 2 for a fan driven primary air flow moving in the direction indicated by the arrow 3 and, downstream of the duct inlet section 2 a nozzle 4 which is spaced from the inlet duct section 2 to provide a peripheral air inlet 5 through which, in operation, the primary air flowing past the peripheral air inlet 5 entrains air from outside the duct section 1 to provide a secondary flow 8 into the nozzle so that a combination of the primary air flow and the secondary air flow passes through the nozzle 4. In another embodiment, the peripheral air inlet 5 comprises a slot or plurality of slots extending around substantially the entire periphery of the duct inlet section 2 in a plane normal to the direction of the primary air flow.

[0011] The greater flow of air formed by the combination of the two flows generates a venturi effect through the nozzle 4 which speeds up the flow of air through the nozzle.

[0012] As shown in cross-section in Figures 1 and 2 the nozzle 4 has three guide vanes 6 arranged in spaced parallel relationship and extending transversely across the duct section 1 to guide the air flow. In cross-section, the vanes 6 have an aerodynamic profile to minimise turbulence as the air passes through the nozzle 4. In the embodiment of the invention shown in Figure 1, the nozzle 4 is arranged to pivot about a point 7 adjacent the periphery of the duct inlet section 2 to deflect the flow of air at an angle to the inlet flow of primary air as indicated by the arrows 3 in the duct inlet section. This arrangement has the effect that secondary air entering adjacent the pivot point 7 travels at a different speed than the secondary air drawn in at other points on the periphery, particularly at a point 180° spaced from this pivot point 7, where the peripheral gap is wider. This speed difference can be used to bring about change in the flow direction. This has advantages in directing the flow leaving the nozzle 4.

[0013] The periphery of the nozzle 4 has a profile in cross section which has the same or slightly smaller internal diameter than that of the duct inlet section 2 and

on the upstream edge 9 of the nozzle the profile is curved outwardly radially as shown to provide a smooth transition for both the primary and the secondary air flows into the nozzle 4.

[0014] The referring now also to Figure 3, there is shown a part sectional view of the duct section in which the vanes in the nozzle have been removed from the nozzle in the interests of clarity. The arrows 8 indicate the secondary air flow passing into the interior of the duct section 1 to combine with the primary air flow as both the air flows pass through the nozzle 4.

[0015] Figure 4 illustrates schematically, by means of bubbles, the general disposition of the air flows. The primary air flow 3 enters the duct section 1 in the direction of the arrow 3and the secondary air flow 8 passes through the secondary air gap 5 to combine with the primary air flow so a much greater volume of air passes through the nozzle 4 as indicated by the density of the bubbles. Thus, a venturi effect through the nozzle is generated.

[0016] It will be understood that different embodiments of the nozzle 4 may arrange for the guide vanes to be pivoted in a different manner. For example, the nozzle could be pivoted about a transverse axis located on the axial axis of the duct section 1 so that the peripheral air inlet 5 has a reduced gap at one edge and an increased gap at the edges located 180° apart when it is tilted. It is also possible for the vanes to be connected via a linkage arrangement movable to tilt the vanes simultaneously whilst retaining them in spaced parallel relationship. Although three vanes are shown it will be understood that the number of vanes provided would depend upon the requirements of the particular installation and could therefore be one or more. Although shown as circular in cross-section, it will be understood that the duct could have a square, rectangular or other cross section.

Claims

1. A duct section for an air movement duct, comprising a duct inlet section (2) having a primary air inlet for a fan driven primary air flow, the duct section (1) further having a peripheral air inlet (5) downstream of the primary air inlet through which a secondary air flow (8) is drawn into the duct section (1) by entrainment by the passing primary air flow (3) to form a combined air flow of both the primary and the secondary air flows, a nozzle (4) comprising a guide vane arrangement being located downstream of the peripheral air inlet (5) so as to be impinged by and to direct the combined air flows, wherein the guide vane arrangement of the nozzle (4) comprises a plurality of guide vanes (6) in spaced parallel relationship and extending transversely across the duct section (1), **characterised in that**:
   the guide vanes (6) are elongate and arranged to be pivotable about their longitudinal dimension transverse to the direction of the air movement whilst remaining in the parallel relationship, the nozzle (4) being pivotable about an axis (7) substantially aligned with the periphery of the duct section (2) to incline the vanes at an angle to the flow direction of the combined air flows to deflect and guide the airflows.

2. A duct section for an air movement duct according to claim 1, wherein the nozzle (4) comprises a further part of the duct section (1) spaced from the duct inlet section (2) to form the peripheral air inlet (5) therebetween.

3. A duct section for an air movement duct according to claim 1 wherein the peripheral air inlet (5) comprises a slot or plurality of slots extending around substantially the entire periphery of the duct inlet section (2) in a plane normal to the direction of the primary air flow.

4. A duct section for an air movement duct according to claim any one of claims 1 to 3, wherein the nozzle (4) is pivotable by up to 20° from the axis of the primary airflow duct inlet section (2).

5. A duct section for an air movement duct according to any one of the preceding claims, wherein the periphery of the inlet side of the nozzle (4) is profiled, in cross-section, to provide a curved inlet edge forming a smooth transition of the intemal surface of the duct section (2) for the air flow from the primary duct section through the guide vanes (6) irrespective of the angular displacement of the nozzle.

Patentansprüche

1. Leitungsabschnitt für eine Luftbewegungsleitung, umfassend einen Leitungseinlassabschnitt (2) mit einem Primärlufteinlass für einen von einem Gebläse geförderten Primärluftstrom, wobei der Leitungsabschnitt (1) weiter einen dem Primärlufteinlass nachgeschalteten Umfangslufteinlass (5) aufweist, durch den ein Sekundärluftstrom (8) durch Mitnahme durch den vorbeiströmenden Primärluftstrom (3) zur Bildung eines Verbundluftstroms aus dem Primär- und den Sekundärluftstrom in den Leitungsabschnitt (1) gesaugt wird, wobei eine Düse (4) mit einer Leitschaufelanordnung dem Umfangslufteinlass (5) nachgeschaltet ist, um von den Verbundluftströmen beaufschlagt zu werden und diese zu leiten, wobei die Leitschaufelanordnung der Düse (4) eine Vielzahl von Leitschaufeln (6) mit beabstandeter Parallelanordnung umfasst, die sich quer über den Leitungsabschnitt (1) erstrecken, **dadurch gekennzeichnet, dass** die Leitschaufeln (6) länglich und um ihre Längsabmessung quer zur Richtung der Luftbewegung unter Beibehaltung ihrer Parallelan-

ordnung verschwenkbar sind, wobei die Düse (4) um eine im Wesentlichen nach dem Umfang des Leitungsabschnitts (2) ausgerichtete Achse (7) verschwenkbar ist, um die Schaufeln zur Ableitung und Führung der Luftströme auf einen Winkel zur Strömungsrichtung der Verbundluftströme einzustellen.

2. Leitungsabschnitt für eine Luftbewegungsleitung nach Anspruch 1, wobei die Düse (4) einen weiteren Teil des Leitungsabschnitts (1) umfasst, der zur Bildung des Umfangslufteinlasses (5) dazwischen vom Leitungseinlassabschnitt (2) beabstandet ist.

3. Leitungsabschnitt für eine Luftbewegungsleitung nach Anspruch 1, wobei der Umfangslufteinlass (5) einen Schlitz oder eine Vielzahl von Schlitzen umfasst, der/die sich in einer Ebene senkrecht zur Richtung des Primärluftstroms im Wesentlichen um den gesamten Umfang des Leitungseinlassabschnitts (2) erstreckt/erstrecken.

4. Leitungsabschnitt für eine Luftbewegungsleitung nach einem der Ansprüche 1 bis 3, wobei die Düse (4) um bis zu 20° von der Achse des Leitungseinlassabschnitts (2) für den Primärluftstrom weg verschwenkbar ist.

5. Leitungsabschnitt für eine Luftbewegungsleitung nach einem der vorhergehenden Ansprüche, wobei der Umfang der Einlassseite der Düse (4) zur Herstellung eines bogenförmigen Einlassrandes, der einen glatten Übergang der Innenfläche des Leitungsabschnitts (2) für den Luftstrom aus dem Primärleitungsabschnitt durch die Leitschaufeln (6) ungeachtet der Winkelverschiebung der Düse bildet, im Querschnitt profiliert ist.

Revendications

1. Section de conduit pour un conduit de circulation d'air, comprenant une section d'entrée de conduit (2) ayant une entrée d'air primaire pour un écoulement d'air primaire entraîné par un ventilateur, la section de conduit (1) ayant en outre une entrée d'air périphérique (5) en aval de l'entrée d'air primaire à travers laquelle un écoulement d'air secondaire (8) est attiré dans la section de conduit (1) par entraînement par l'écoulement d'air primaire (3) qui passe pour former un écoulement d'air combiné à la fois des écoulements d'air primaire et secondaire, une buse (4) comprenant un agencement d'aubes directrices qui est situé en aval de l'entrée d'air périphérique (5) de manière à être affecté par et à diriger les écoulements d'air combinés, dans laquelle l'agencement d'aubes directrices de la buse (4) comprend une pluralité d'aubes directrices (6) dans une relation parallèle espacée et s'étendant de manière transversale en travers de la section de conduit (1), **caractérisée en ce que** :
les aubes directrices (6) sont allongées et agencées pour être pivotantes autour de leur dimension longitudinale transversale à la direction de la circulation d'air tout en restant dans la relation parallèle, la buse (4) étant pivotante autour d'un axe (7) essentiellement aligné avec la périphérie de la section de conduit (2) pour incliner les aubes à un angle par rapport à la direction d'écoulement des écoulements d'air combinés pour dévier et guider les écoulements d'air.

2. Section de conduit pour un conduit de circulation d'air selon la revendication 1, dans laquelle la buse (4) comprend une autre partie de la section de conduit (1) espacée de la section d'entrée de conduit (2) pour former l'entrée d'air périphérique (5) entre elles.

3. Section de conduit pour un conduit de circulation d'air selon la revendication 1, dans laquelle l'entrée d'air périphérique (5) comprend une fente ou pluralité de fentes s'étendant autour essentiellement de la périphérie entière de la section d'entrée de conduit (2) dans un plan perpendiculaire à la direction de l'écoulement d'air primaire.

4. Section de conduit pour un conduit de circulation d'air selon l'une quelconque des revendications 1 à 3, dans laquelle la buse (4) est pivotante de jusqu'à 20° de l'axe de la section d'entrée de conduit d'écoulement d'air primaire (2).

5. Section de conduit pour un conduit de circulation d'air selon l'une quelconque des revendications précédentes, dans laquelle la périphérie du côté d'entrée de la buse (4) est profilée, en coupe transversale, pour fournir un bord d'entrée courbé formant une transition lisse de la surface interne de la section de conduit (2) pour l'écoulement d'air depuis la section de conduit primaire à travers les aubes directrices (6) quel que soit le déplacement angulaire de la buse.

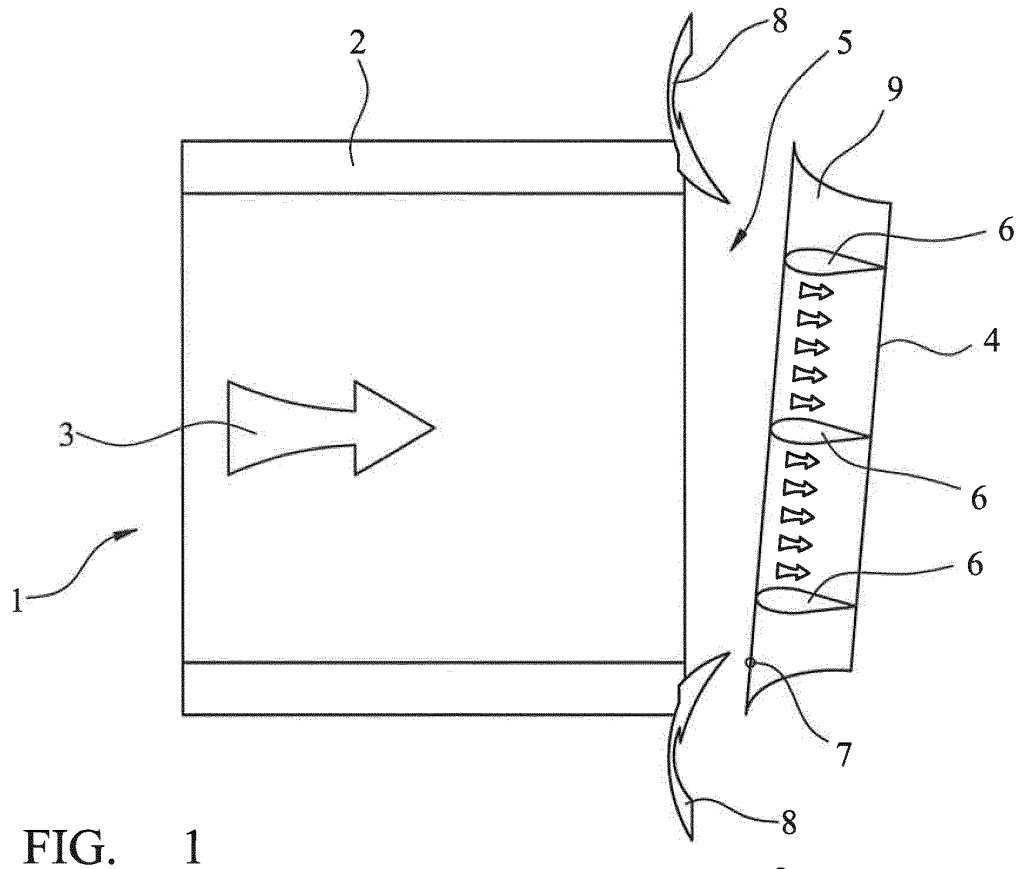


FIG. 1

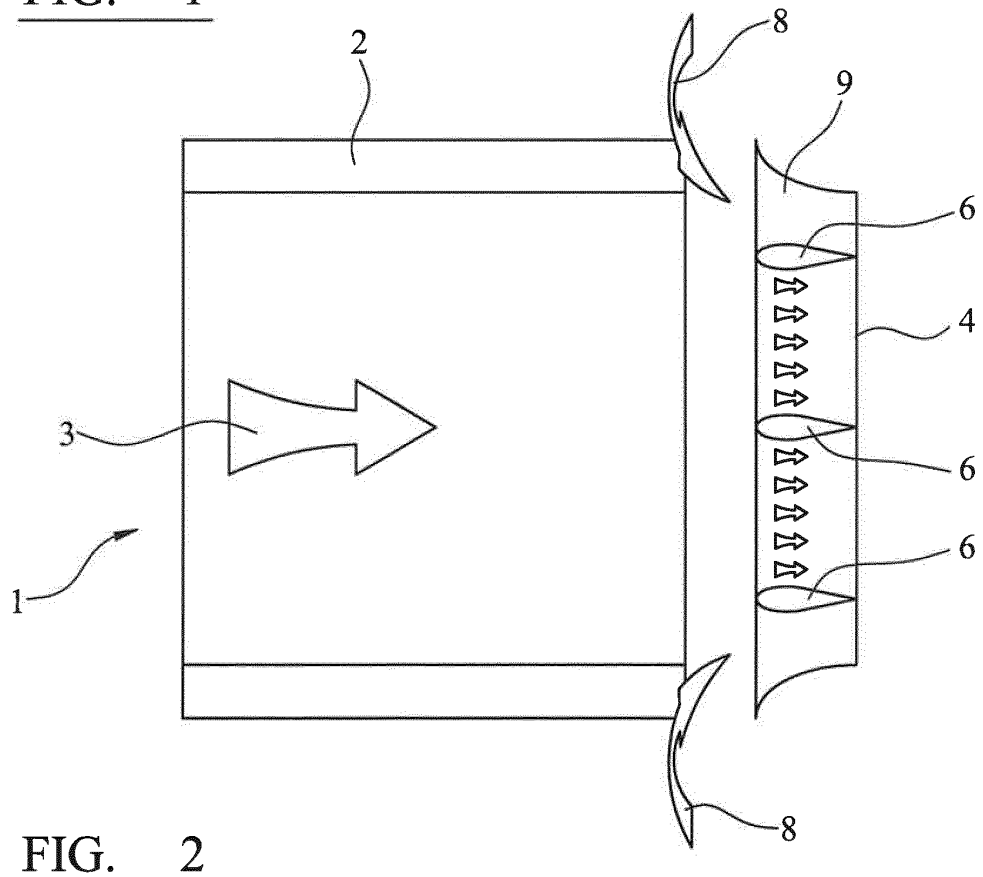
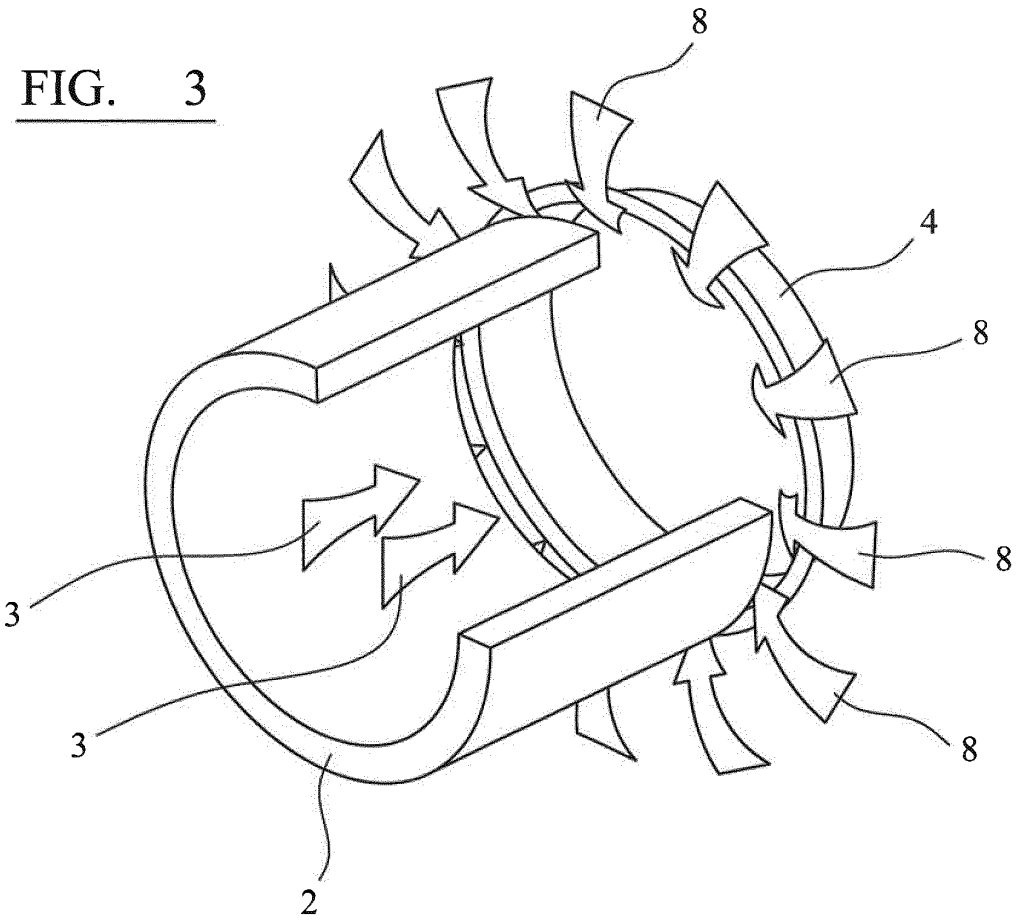


FIG. 2

FIG. 3



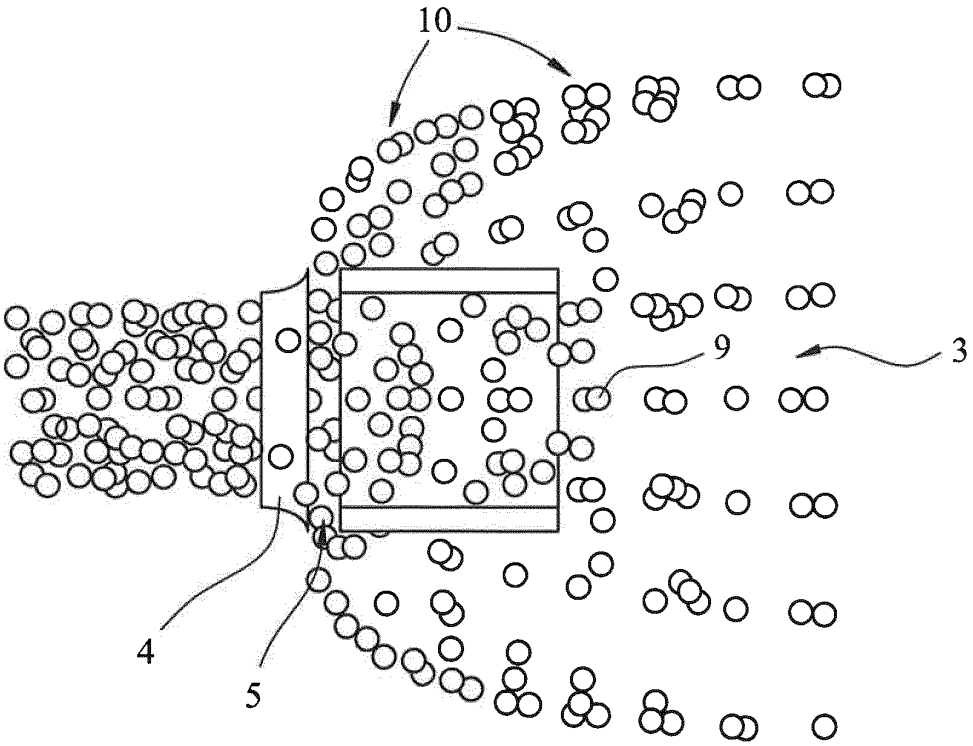


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4255176 A **[0003]**