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

(11) **EP 3 620 239 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.03.2020 Bulletin 2020/11

(51) Int Cl.:
B08B 5/04 *(2006.01)* ***A47L 9/06*** *(2006.01)*

(21) Application number: **19195756.2**

(22) Date of filing: **05.09.2019**

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **05.09.2018 GB 201814459**

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(54) **DEVICE AND METHOD FOR REMOVING PARTICULATES**

(57) A particulate removal method and device (1) suitable for removing any residual particulates from the milling process of an elongate body (16) such as the slat of a garage door. The particulate removal device (1) having a particulate removal chamber (2) that is configured to house, at least in part, a portion of an elongate body to be treated (16). The particulate removal chamber is configured to create a turbulent flow (17) which acts on the surfaces of the elongate body (16) to be treated to remove the particulate from said surfaces.

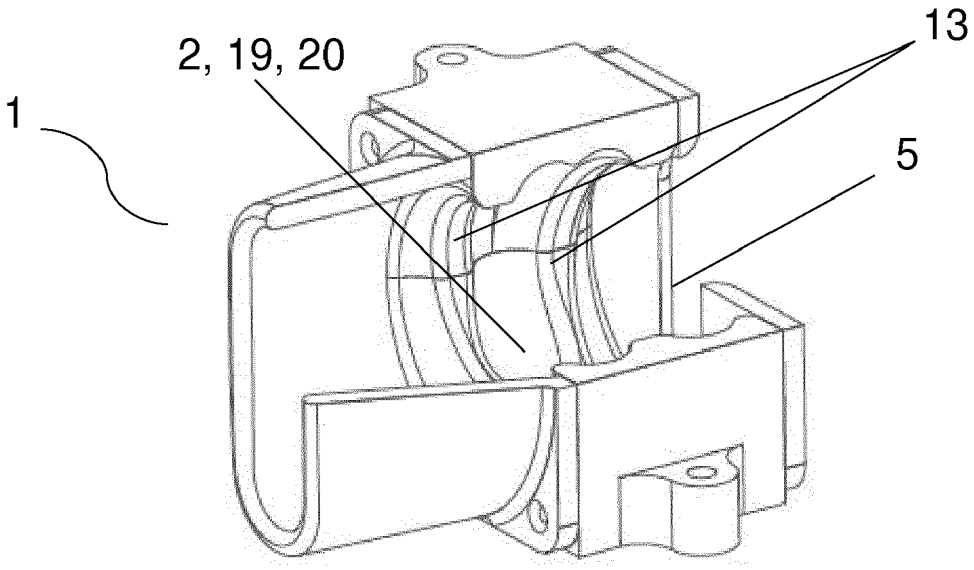


Fig 2

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Description

[0001] The present invention relates to an improved device for removing particulate, preferably from an elongate body, and in particular of the type to be attached to a suction apparatus.

[0002] Cutting metal results in a fine particulate by-product known as swarf. Owing to the nature of cutting metal each swarf filing comprises rough edges often with sharp points that can often cause injury to machine operators and damage to the cut products. One such example of this recurring problem regards the cutting of metal-wrapped elongate panels that can be arranged together to construct modern garage doors.

[0003] Garage doors are constructed by the interlocking of elongated body panels, comprising an insulated core wrapped in a durable metal coating. Typically, these panels come in standard widths and, depending on the dimensions of the opening into which a garage door is to be fitted, can be cut length wise to fit the aperture in a building. After having being cut, the panels are aligned to form the requisite size of door and fit together using, for instance, a tongue and groove friction fit before being framed in a durable material such as a galvanized metal to form the garage door. Opening and locking means are attached prior to hanging in the corresponding building aperture.

[0004] Issues arise following the cutting of the panels as swarf filings tend to disseminate in a widespread and chaotic manner during the cutting process. Many temporarily bed in the groove portion of the panel becoming loose during installation and scratching the surface of the panels. This tarnishes the aesthetic of the completed garage door and often leads to unsatisfied customers. This in turn costs both the supplier and the installer time and money as one or both will be obliged to replace either the panels or the entire door to meet the customer's needs.

[0005] Replacing a scratched panel is extremely time consuming as it involves removing the damaged panel from the garage door arrangement by taking it down from its in use position, removing any additional hanging or opening/locking means, unframing the entire door before removing and replacing the offending scratched panels. Meanwhile, replacing a garage door on the whole is a costly endeavor for the supplier as they must respect the contact with the customer and cut their losses on damaged resources.

[0006] Therefore, there is a need to obviate or mitigate the problem of particulate, arising from the cutting process of elongate garage door components, damaging the aesthetic of completed garage doors by becoming dislodged and scratching the component panels either in transit or during the installation process. Obviating or mitigating this problem will reduce the cost, in terms of damaged resources and time spent, by both the supplier and the installer during the manufacturing, transit and installation processes respectively.

[0007] It is an object of the present invention to prevent or mitigate the above-mentioned problems of particulates, thus providing an improved device configured for removing the particulates - arising from the cutting process of elongate bodies, in particular of elongate garage door components - without causing any damage to the surfaces of the elongate body.

[0008] Another object of the invention is to provide a particulate removing device that can be industrially manufactured.

[0009] Another object of the invention is to provide a particulate removing device that has an alternative and improved characterisation and design, in both constructional and functional terms, compared with the known ones.

[0010] Another object of the invention is to provide a particulate removing device of easy and low-cost manufacturing and that enables easy and quick use with all kinds of commercially available suction sources.

[0011] Accordingly, all of these objects, taken individually and in any combination thereof, are achieved according to the present invention by providing a device for removing particulate from an elongate body, that comprises:

- a particulate removal chamber configured to house, at least, a portion of an elongate body;
- an entry aperture configured to allow at least a portion of the elongate body to enter said particulate removal chamber;
- coupling means for coupling the particulate removal chamber with a suction apparatus,

wherein the particulate removal the chamber is configured/designed to create a turbulent airflow acting on at least one surface of the at least a portion of the elongate body so as to remove the particulate from the at least one surface.

[0012] Preferably, the coupling means couples the interior of the particulate removal chamber with a suction apparatus.

[0013] Preferably, the interior of the particulate removal chamber is configured/designed to create a turbulent airflow acting on at least one surface of the elongate body so as to remove the particulate from the at least one surface.

[0014] Ideally, the elongate body entry aperture corresponds in size to the perimeter of the elongate body.

[0015] Ideally, the elongate body entry aperture corresponds in size to the cross-sectional perimeter of the elongate body.

[0016] Ideally, the elongate body entry aperture is the same size as or slightly bigger than the perimeter of the elongate body.

[0017] Ideally, the elongate body entry aperture is the same size as or slightly bigger than the cross-sectional perimeter of the elongate body

[0018] Ideally, the elongate body entry aperture is lo-

cated on a wall of the particulate removal device.

[0019] Ideally, the elongate body entry aperture penetrates a wall of the particulate removal device.

[0020] Ideally, the elongate body entry aperture and/or the elongate exit aperture are sized and shaped so as to allow the insertion of a slat of a garage door.

[0021] Ideally, the elongate body entry aperture penetrates a wall of the particulate removal device leading to the particulate removal chamber.

[0022] Ideally, the elongate body entry aperture penetrates a first wall of the particulate removal device leading to the particulate removal chamber.

[0023] Ideally, the elongate body entry aperture defines a passage for entering into the particulate removal chamber.

[0024] Ideally, the elongate body entry aperture allows the elongate body to interact with the particulate removal device by entering into the particulate removal chamber.

[0025] Ideally, the elongate body entry aperture allows the elongate body to interact with the particulate removal device by being initially passed through the elongate body entry aperture into the particulate removal chamber.

[0026] Ideally, the device further comprises an exit aperture configured to allow the at least a portion of the elongate body to be removable from the particulate removal chamber.

[0027] Preferably, the elongate body exit aperture corresponds in size to the elongate body entry aperture.

[0028] Preferably, the elongate body exit aperture is the same size as the elongate body entry aperture.

[0029] Ideally, the elongate body exit aperture is located on a second wall of the particulate removal device.

[0030] Ideally, the elongate body exit aperture defines a passage for exiting from the particulate removal chamber.

[0031] Preferably, the elongate body entry aperture and/or the elongate body exit aperture comprise an opening defined on respective walls of the particulate removal device.

[0032] Preferably, the elongate body entry aperture and/or the elongate body exit aperture comprise an opening defined on a respective wall of the particulate removal device and an elongate mouth developing from the corresponding wall and connected/aligned with said opening.

[0033] Preferably, the elongate mouth tapers down as it develops away from the corresponding wall on which is defined said opening.

[0034] Ideally, the second wall of the particulate removal device containing the elongate body exit aperture faces the first wall of the particulate removal device containing the elongate body entry aperture.

[0035] Ideally, the second wall of the particulate removal device containing the elongate body exit aperture is opposite the first wall of the particulate removal device containing the elongate body entry aperture.

[0036] Ideally, the elongate body entry aperture faces the elongate body exit aperture.

[0037] Ideally, the elongate body entry aperture is opposite to the elongate body exit aperture.

[0038] Ideally, the elongate body entry aperture is directly opposite to the elongate body exit aperture.

[0039] Ideally, the elongate body entry aperture is aligned with and directly opposite to the elongate body exit aperture.

[0040] Ideally, the elongate body entry aperture is aligned with and directly opposite to the elongate body exit aperture so that the elongate body can be passed through the particulate removal device.

[0041] Ideally, the elongate body entry aperture is directly opposite to the elongate body exit aperture so that the elongate body can enter through the elongate body entry aperture, can pass through the particulate removal chamber and can come out through the elongate body exit aperture of the particulate removal device.

[0042] Ideally, the elongate body entry aperture is directly opposite to the elongate body exit aperture so that the elongate body can be passed through the particulate removal device in a linear way along the length of the elongate body.

[0043] Advantageously, having the entry aperture and the exit aperture arranged in such a manner that they are aligned opposite one another in a linear way means that the elongate body can be passed through the particulate removal device without deviating from the linear longitudinal axis of the elongate body so that is will not be physically damaged or distorted during the particulate removal process.

[0044] Preferably, the particulate removal chamber is configured for removing particulate from at least one surface of the elongate body.

[0045] Preferably, the particulate removal chamber is configured for removing particulate from the elongate body.

[0046] Ideally, the particulate removal chamber is configured and adapted in size and/or shape for removing the particulate from at least one the elongate body.

[0047] Ideally, the particulate removal chamber is configured and adapted in size and/or shape for removing the particulate from the elongate body.

[0048] Preferably, the particulate removal chamber comprises a hollow portion.

[0049] Ideally, the hollow portion is configured in size and/or shape for housing at least in part the elongate body.

[0050] Preferably, the particulate removal chamber comprises a cavity.

[0051] Ideally, the cavity is configured in size and/or shape for housing at least in part the elongate body.

[0052] Preferably, the particulate removal chamber comprises a channel.

[0053] Ideally, the channel is configured in size and/or shape for housing at least in part the elongate body.

[0054] Preferably, the particulate removal chamber is configured for guiding airflow within and around the interior of the particulate removal chamber for removing par-

ticulate from at least one surface of at least a portion of an elongate body.

[0055] Preferably, the particulate removal chamber is configured for guiding airflow within and around the interior of the particulate removal chamber for removing particulate from at least one surface of an elongate body.

[0056] Preferably, the particulate removal chamber is configured for guiding airflow within and around the interior of the particulate removal chamber for removing particulate from the surfaces of an elongate body.

[0057] Ideally, the particulate removal chamber is configured/adapted for guiding airflow within and around the interior particulate removal chamber, thus creating a turbulent air flow for extracting particulate from at least one surface of at least a portion of the elongate body on the application of a suction force provided by a suction apparatus.

[0058] Ideally, the particulate removal chamber is configured/adapted for guiding airflow within and around the interior particulate removal chamber, thus creating a turbulent air flow for extracting particulate from the surfaces of the elongate body on the application of a suction force provided by a suction apparatus.

[0059] Preferably, the interior faces of the particulate removal chamber delimit the particulate removal chamber and are shaped and sized so as to create, within the same chamber, a turbulent air flow that enables the removal of the particulate from the surfaces of at least a portion of the elongate body that is inserted and housed within the chamber.

[0060] Ideally, the interior faces of the chamber are shaped so as to define at least two adjacent annular portions having a variable longitudinal extension along their circular development.

[0061] Ideally, the interior faces of the chamber are shaped so as to define ridge projections having a variable longitudinal extension along their circular development.

[0062] Ideally, the interior faces of the chamber are shaped so as to define at least two ridge projections having a variable longitudinal extension along their circular development

[0063] Advantageously, using turbulent air to remove the particulate from the elongate body enables particulate such as swarf to be removed away from the elongate body without first scratching or damaging the elongate body. Particulate is therefore lifted away from the elongate body before being directed, via the suction apparatus coupling means, into the receiving chamber of the attached suction apparatus.

[0064] Ideally, the particulate removal chamber extends from the first wall to the second wall of the particulate removal device.

[0065] Ideally, the particulate removal chamber extends from the elongate body entry aperture on the first wall to the elongate body exit aperture on the second wall of the particulate removal device.

[0066] Ideally, the particulate removal chamber extends from the elongate body entry aperture to the elongate body exit aperture.

[0067] Ideally, the particulate removal chamber comprises a cavity extending from opposite walls of the particulate removal device.

[0068] Ideally, the particulate removal chamber comprises a cavity extending from the first wall and the second wall of the particulate removal device.

[0069] Ideally, the particulate removal chamber extends radially inwardly to the elongate body exit aperture.

[0070] Ideally, the particulate removal chamber extends from the elongate body entry aperture radially inwardly to the elongate body exit aperture.

[0071] Ideally, the particulate removal chamber extends from the elongate body entry aperture radially inwardly in a frusto-conical way to the elongate body exit aperture.

[0072] Ideally, the particulate removal chamber tapers to the elongate body exit aperture.

[0073] Ideally, the particulate removal chamber comprises a cavity and a channel that extends the length of said cavity.

[0074] Ideally, the channel extends in the elongate mouth defining the exit aperture.

[0075] Ideally, the channel is defined by the elongate mouth defining the exit aperture.

[0076] Ideally, the channel extends the length of the cavity delimited between the first wall and the second wall of the particulate removal device.

[0077] Ideally, the channel extends continuously along the length of cavity extending from the first wall to the second wall of the particulate removal device.

[0078] Ideally, the channel extends continuously from the length of cavity extending from the elongate body entry aperture to the elongate body exit aperture of the particulate removal device.

[0079] Ideally, the channel tapers to the elongate body exit aperture.

[0080] Advantageously, having the particulate removal chamber taper down to the elongate body exit aperture increases the pressure gradient between the elongate body exit aperture and the particulate removal chamber thereby increasing the suction effect at the mouth of the particulate removal device. This helps to draw the particulate out from any nooks or crannies along the length of the elongate body when being passed through the elongate body entry aperture.

[0081] Ideally, the particulate removal device comprises a dampening means.

[0082] Ideally, the dampening means is detachably couplable to the elongate body exit aperture.

[0083] Ideally, the dampening means dampens the loss of suction provided by the suction apparatus.

[0084] Ideally, the dampening means dampens the loss of suction at the elongate body exit aperture.

[0085] Ideally, the dampening means dampens the loss of suction at the elongate body exit aperture by decreasing the surface area of the elongate body exit aperture.

[0086] Ideally, the dampening means decreases the area of the elongate body exit aperture by minimizing any gap between the elongate body and the elongate body aperture.

[0087] Ideally, the dampening means decreases the area of the elongate body exit aperture by minimizing any gap between the elongate body and the elongate body aperture when the elongate body is being passed through the particulate removal device.

[0088] Advantageously, by minimizing the gap between the elongate body exit aperture and the elongate body the dampening means maintains the force of suction throughout the particulate removal chamber. By ensuring the force remains constant throughout the particulate removal chamber the dampening means reduces the risk that some particulate debris will remain unextracted along the length of the elongate body.

[0089] Ideally, the dampening means comprises a material, cloth or fabric or any other suitable textile.

[0090] Advantageously, by making the dampening means from a textile it can act to gently brush any residual particulate from the grooves in the elongate body that were not dislodged by the turbulent airflow in the particulate removal chamber.

[0091] Ideally, the particulate removal device comprises coupling means for a suction apparatus, said coupling means being configured for attaching a suction means or an appropriate attachment thereof to the particulate removal device.

[0092] Ideally, the suction apparatus coupling means are configured to detachably couple the particulate removal device to the suction apparatus.

[0093] Ideally, the suction apparatus coupling means comprises an opening.

[0094] Ideally, the suction apparatus coupling means comprises an opening located on a third wall of the particulate removal device.

[0095] Ideally, the opening is of sufficient size to allow attachment of a suction apparatus.

[0096] Ideally, the opening is configured in shape and/or size to allow attachment of a suction apparatus, and in particular of a suction source or of an appropriate attachment thereof.

[0097] Ideally, the suction apparatus is a vacuum cleaner.

[0098] Ideally, the suction apparatus comprises an appropriate attachment of a vacuum cleaner. Preferably, the suction apparatus comprises a vacuum cleaner hose, nozzle, or any other attachment of sufficient size to attach the suction source to the particulate removal device via the suction source attachment aperture.

[0099] Advantageously, the suction source coupling means is designed to mate/couple with any vacuum cleaner either directly or indirectly via an intermediate appropriate attachment thereof. This makes the particulate removal device universally accessible as it is capable of coupling with any commercially available vacuum cleaner.

[0100] Ideally, the suction apparatus coupling means enables particulate to be removed from the particulate removal device.

[0101] Ideally, the suction apparatus coupling means enables particulate to be removed from the particulate removal device through the suction apparatus coupling means and into the suction apparatus.

[0102] Preferably, the particulate removal device has a parallelepiped shape. Ideally, the particulate removal device has a cuboid shape.

[0103] Preferably, the particulate removal device is made from plastic.

[0104] Preferably, the particulate removal device consists of one modular unitary component.

[0105] Preferably, the particulate removal device consists of an extruded modular unitary component.

[0106] Preferably, the particulate removal device consists of a plurality of co-operating components.

[0107] Preferably, the plurality of co-operating components comprises:

- a first component defining, at least in part, the base portion of particulate removal chamber,
- a second component defining, at least in part, the top portion of the particulate removal chamber,
- a third component defining the first wall of the particulate removal device, and
- a fourth component defining the second wall of the particulate removal device.

[0108] Ideally, the elongate mouth is defined on the third and/or fourth component.

[0109] Ideally, the plurality of co-operating components comprising means for their reciprocal joining.

[0110] Ideally, the joining means comprising fastening means and receiving means.

[0111] Ideally, the co-operating components are detachably joinable to one another in a predetermined fashion.

[0112] Ideally, the co-operating components are detachably joinable to one another in a predetermined fashion using fastening means and receiving means.

[0113] Ideally, the fastening means comprising nuts and bolt, screws, or any other suitable means of fastening one component of the particulate removal device to another component of the particulate removal device in a predetermined location.

[0114] Ideally, the receiving means comprising bores or through-bores located at a predetermined site on either the main body of a component of the particulate removal device or an appropriate fixing tab thereof.

[0115] Ideally, the suction apparatus coupling means are defined in the first component and/or in the second component.

[0116] Ideally, the suction apparatus coupling means are defined on the underside face of the first component when positioned in situ.

[0117] Ideally, the first component is detachably join-

able to the second component so as to define at least in part the particulate removal chamber.

[0118] Ideally, the first component is detachably joinable to the second component so as to define at least in part the cavity of the particulate removal chamber.

[0119] Ideally, the base portion of the particulate removal chamber is detachably couplable to the top portion of the particulate removal chamber, so as to form the particulate removal chamber, via inserting fastening means through receiving means on the respective components so that they align in a co-operative predetermined fashion.

[0120] Ideally, the first component and the second component are joinable via inserting fastening means through receiving means on the respective components so that they align in a co-operative predetermined way.

[0121] Ideally, the third component is detachably joinable to one side of the first and second components where an open end of the channel is located.

[0122] Ideally, the third component is detachably joinable to one side of the first and second components by inserting appropriate fastening means into the receiving means of the third component and fastening them to the components defining, at least in part, the particulate removal chamber.

[0123] Ideally, the fourth component comprises the second wall provided with the elongate mouth defining the exit aperture.

[0124] Ideally, the fourth component is detachably joinable to another/opposite side of the first and second components where an open end of the channel is located.

[0125] Ideally, the fourth component is detachably joinable to another/opposite side of the first and second components by inserting appropriate fastening means into the receiving means of the fourth component and fastening them to the components defining, at least in part, the particulate removal chamber.

[0126] Ideally, the third component comprise the elongate body entry aperture while the fourth component comprise the elongate body exit aperture, or vice versa.

[0127] Advantageously, the particulate removal chamber is designed so that either the third component and/or the fourth component can be joined to either open end side of the cavity defining the chamber and obtained by joining together the first and second component.

[0128] Advantageously, by incorporating universal coupling locations on third component or fourth component of the particulate removal device and on the components defining the base and the top portions of the particulate removal chamber, the risk of incorrect assembly is eliminated. This is because it makes no difference to which end of the particulate removal chamber the third component or fourth component is joined since, once that one of the two components is joined at one end of the chamber, the other component may be easily joined at the other end of the same chamber.

[0129] Ideally, in use an operator of the particulate removal device couples a suction apparatus to the suction apparatus coupling means located on the third wall of the device. The operator activates suction drawing air from inside the particulate removal chamber to outside of the particulate removal chamber and into the suction apparatus. Due to the configuration of the interior wall of the particulate removal chamber the generated suction stream of the suction apparatus is guided along at least a portion of the interior wall of the chamber drawing airflow into the suction apparatus. Furthermore, due to the portions of the interior wall delimiting the particulate removal chamber turbulent airflow is created as air moves from a region proximal to the entry and exit apertures of the device and over the ridge projections of the interior wall of the chamber into the suction stream of the suction apparatus. An elongate body is inserted into the device via the entry aperture passing through the particulate removal chamber and in doing so passing through the generated turbulent air within the chamber towards the device exit aperture. During transit from the entry aperture to the exit aperture particulates are lifted away from the elongate body by the turbulent air into the suction stream of the suction apparatus to be removed from the particulate removal chamber. Upon exit from the chamber the elongate body is delivered up to a damping means. This damping means dampens the loss of suction within the particulate removal chamber upon the exit of the elongate body from the particulate removal chamber. The damping means further comprises textile material to gently brush across the elongate body surface to lift any residual particulates which were not previously dislodged by the turbulent airflow when the portion of the elongate body was within the particulate removal chamber into the suction stream of the suction apparatus for removal.

[0130] Accordingly, all of the above-mentioned objects, taken individually and in any combination thereof, are also achieved according to the present invention by an improved suction system comprising a particulate removal device having one or more of the features previously presented and a suction apparatus that is connected/attached to the device via and at the suction apparatus coupling means.

[0131] Accordingly, the present invention provides a method to remove particulates from a body member by means of turbulent airflow within a particulate removal device, the method comprising the steps of:

Generating a suction force within the particulate removal chamber drawing air into the chamber so as to create the turbulent airflow;

Inserting at least a portion of the body member into the particulate removal chamber via the entrance aperture; and

[0132] Removing the at least a portion of the body member from the particulate removal chamber.

[0133] The method further comprising the step of: Inserting the entire body member into the particulate removal chamber via the entrance aperture; and removing

the entire body member from the particulate removal chamber.

[0134] The method further comprising the step of: coupling a vacuum either directly or indirectly to the particulate removal device to generate a suction force within the particulate removal chamber.

[0135] The method further comprising the step of: passing the body member from an entrance aperture of the particulate removal device and through the particulate removal chamber in a direction towards the exit aperture.

[0136] The method further comprising the step of: passing the body member from an entrance aperture of the particulate removal device through the particulate removal chamber in a linear direction towards the exit aperture of the particulate removal device along the linear longitudinal axis of the particulate removal device.

[0137] The method further comprising the step of upon exiting the particulate removal chamber the body member is delivered up to a damping means to dampen the loss of suction within the particulate removal chamber upon exit of a portion of the body member from the particulate removal chamber.

[0138] The method further comprising the step of: removing residual particulates from the body member which were not previously dislodged by the turbulent airflow within the particulate removal chamber.

[0139] The method further comprising the step of: gently brushing residual particulates from the body member which were not previously dislodged by the turbulent airflow within the particulate removal chamber.

[0140] Accordingly, the present invention provides a method to remove particulates from an elongate body by means of turbulent airflow within a particulate removal device, the device having an entrance aperture and an exit aperture with a particulate removal chamber extending therein between, the particulate removal chamber having a corrugated surface, the method comprising the steps of:

Generating a suction force within the particulate removal chamber drawing air into the chamber so as to create the turbulent airflow;

Inserting a at least a portion of the body member into the particulate removal chamber via the entrance aperture; and

Removing the at least a portion of the elongate body from the particulate removal chamber.

[0141] The method further comprising the step of: Inserting the entire body member into the particulate removal chamber via the entrance aperture; and removing the entire body member from the particulate removal chamber.

[0142] The skilled man will appreciate that all preferred or optional features of the invention described with reference to only some aspects or embodiments of the invention may be applied to all aspects of the invention.

[0143] It will be appreciated that optional features applicable to one aspect of the invention can be used in any combination, and in any number. Moreover, they can also be used with any of the other aspects of the invention in any combination and in any number. This includes, but is not limited to, the dependent claims from any claim being used as dependent claims for any other claim in the claims of this application.

[0144] The invention will now be described with reference to the accompanying drawing which shows by way of example only one embodiment of an apparatus in accordance with the invention.

[0145] In the drawings:

- Fig 1 is a perspective view of one embodiment of the particulate removal device,
- Fig 2 is a perspective view of one embodiment of the particulate removal device with a section removed along the line A-A in Fig 1,
- Fig 3 is an exploded view of the plurality of co-operating components of the embodiment of the particulate removal device of Fig. 1,
- Fig 4 is a perspective view of the third component defining the first wall of the particulate removal device of the embodiment of the device of Fig. 1,
- Fig 5 is a bottom plan view of the first component defining the base portion of the cavity of the particulate removal chamber of the embodiment of the device of Fig. 1,
- Fig 6 is a top plan view of the first component defining the base portion of the cavity of the particulate removal chamber of the embodiment of the device of Fig.1,
- Fig 7 is a perspective view of the fourth component defining the second wall of the particulate removal device of the embodiment of the device of Fig. 1
- Fig 8 is a top plan view of the fourth component of Fig. 7,
- Fig. 9 is a bottom plan view of the second component defining the top portion of the cavity of the embodiment of the device of Fig. 1,
- Fig 10 is a front view of the second component of the embodiment of the device of Fig. 1,
- Fig 11 is a top plan view of the second component of Fig. 10.
- Fig 12 is a front plan view of the embodiment of the device of Fig.1 with component 3 not attached with an elongate body inserted into the device illustrating turbulent airflow.

[0146] Referring to the figures, there is shown a device, that is indicated generally by the reference numeral 1, for removing the particulate of elongate bodies and, specifically, the ones arising from the cutting or milling process of elongate bodies 16, such as the slat of a garage door.

[0147] Preferably but not exclusively, the device 1 shown in the figures is suitable for removing any residual particulates from the milling process of an elongate body 16 such as the slat of a garage door.

[0148] The device 1 comprises:

- a particulate removal chamber 2 that is configured to house, at least in part, a portion of an elongate body to be treated 16; the interior of the chamber is configured to create a turbulent flow 17 acting on the surfaces of the elongate body 16 to be treated so as to remove the particulate from said surfaces,
- an aperture 5 for the entry of an elongate body 16 to be treated into the chamber 2 and an exit aperture 6 for the exit of the same elongate body 16 from said removal chamber 2;
- means 4 for coupling, directly or indirectly, the particulate removal chamber 2 with a suction apparatus (not shown).

[0149] Conveniently, the entry aperture 5 and/or the exit aperture 6 for the elongate body 16 correspond or are slightly bigger in size to the cross-sectional perimeter of the elongate body 16 from which the particulates are intended to be removed.

[0150] Preferably, the entry aperture 5 and/or the exit aperture 6 are roughly sized and shaped so as to allow the insertion of a slat of a garage door 16. More in detail, the entry aperture 5 and/or exit aperture 6 have a perimeter that corresponds or is slightly bigger than the cross-sectional area of the slat of a garage door 16.

[0151] Advantageously, the entry aperture 5 is located on a first wall 7 of the particulate removal device 1 and defines a passage leading to the particulate removal chamber 2. In particular, by passing through the entry aperture 5 the elongate body 16 enters into the particulate removal chamber 2, thus allowing the interaction of the device 1 with the elongate body 16.

[0152] Preferably, the exit aperture 6 corresponds substantially in size to the entry aperture 5. Advantageously, the exit aperture 6 is located on a second wall 8 of the particulate removal device 1 and defines a passage for exiting from the particular removal chamber 2.

[0153] Preferably, the exit aperture 6 comprises an opening, that is defined on the second wall 8, and an elongate mouth 15 developing from the second wall 8 and connected/aligned with said opening. More in detail, the elongate mouth 15 tapers down as it develops away from the second wall 8.

[0154] Conveniently, it is intended that also or only the entry aperture 5 may have an elongate mouth 15 as the one of the exit aperture 6.

[0155] In particular, by passing through the exit aperture 6 the elongate body 16 exits from the particulate removal chamber 2, thus allowing the elongate body 16 to cross completely and entirely the device 1.

[0156] Preferably, the second wall 8 of the device 1 provided with the exit aperture 6, that comprises the elongate mouth 15, faces, and ideally is opposite to, the first wall 7 of the device 1 containing the entry aperture 5.

[0157] Preferably, the exit aperture 6 faces, and ideally is opposite to, the entry aperture 5. More preferably, the exit aperture 6 is directly opposite to and aligned with the entry aperture 5 so that the elongate body 16 can be passed through the device 1.

[0158] Conveniently, the entry aperture 5 and exit aperture 6 are reciprocally disposed/arranged and configured on the facing walls delimiting the chamber 2 so that the elongate body 16 enters through the entry aperture 5, then passes through the chamber 2 and comes out from the latter through the exit aperture 6.

[0159] Advantageously, having the entry aperture 5 and the exit aperture 6 arranged in such a manner that they are aligned opposite one another in a linear way means that the elongate body 16 can be passed through the device 1 without deviating from the linear longitudinal axis of the elongate body 16 so that is will not be physically damaged or distorted during the particulate removal process.

[0160] Preferably, as said, the interior of the chamber 2 is configured and adapted in size and/or shape for removing the particulate from the surfaces of the elongate body 16. The particulate removal chamber 2 comprising a hollow portion (cavity) that is configured both in size and shape to house, at least in part, a portion of the elongate body 16.

[0161] In particular, the chamber 2 is configured and adapted in size and/or shape for guiding airflow within and around the interior of the same chamber 2, thus creating turbulent air flow 17 for extracting/removing particulate from the surface of the elongate body 16 on the application of a suction force provided by a suction apparatus. Conveniently, the interior faces 13 delimiting the chamber 2 are shaped in size and shape so as to create, within the same chamber 2, a turbulent air 17 that enables the removal of the particulates from the surfaces of the portion of the elongate body 16 that is inserted and housed within the chamber 2.

[0162] Conveniently, the interior faces 13 of the chamber 2 are shaped so as to define at least two adjacent ridge projections 22 having a variable longitudinal extension along their circular development.

[0163] Advantageously, using turbulent air 17 to remove the particulate from the elongate body enables particulate such as swarf to be removed away from the surfaces of the elongate body 16 without scratching, abrasions or other damages in the general on the surfaces of the elongate body 16. Therefore, the particulate is lifted away from the elongate body 16 before being directed into the receiving chamber of the attached suction apparatus via the suction source coupling means 4.

[0164] The chamber 2 comprises a cavity 19 extending from the first wall 7 to the second wall 8 of the particulate removal device 1 and, in particular, extends from the entry aperture 5 on the first wall 7 to the second wall 8 of the particulate removal device 1.

[0165] The particulate removal chamber 2 extends from the entry aperture 5 on the first wall 7 radially inwardly, preferably in a frusto-conical way, towards the exit aperture 6. The chamber 2 tapers towards the exit aperture 6.

[0166] Conveniently, the chamber 2 also comprises a channel 20, also shaped and sized, for the passage of the elongate body 16. Preferably, the channel 20 of the chamber 2 extends continuously over the length of the cavity 19 extending from the first wall 7 to the second wall 8 of the particulate removal device 1. Furthermore, the channel 20 extends in the elongate mouth 15 defining the exit aperture 6.

[0167] Advantageously, having the particulate removal chamber 2 tapering down towards the elongate mouth 15 of the exit aperture 6 increases the pressure gradient between the exit aperture 6 and the chamber 2, thereby increasing the suction effect at the mouth of the particulate removal device 1. This helps to draw the particulate out from any nooks or crannies along the length of the elongate body 16 when being passed through the entry aperture 5.

[0168] Advantageously, the particulate removal device 1 also comprises dampening means (not shown) that are detachably couplable to the exit aperture 6. In particular, the dampening means are configured to dampen the loss of suction at the exit aperture 6.

[0169] The dampening means dampens the loss of suction at the exit aperture 6 by decreasing the surface passing area of the exit aperture, and in particular by minimizing any gap/area between the elongate body 16 and the exit aperture 6 when the elongate body 16 is being passed through the device 1. Advantageously, by minimizing the gap between the exit aperture 6 and the elongate body 16 the dampening means maintains the force of suction throughout the particulate removal chamber 2. By ensuring the force remains constant throughout the particulate removal chamber 2 the dampening means reduces the risk that some particulate debris will remain unextracted along the length of the elongate body 16. Preferably, the dampening means comprises a material, cloth or fabric or any other suitable textile. In particular, by making the dampening means from a textile it can act to gently brush any residual particulate from the grooves in the elongate body 16 that were not dislodged by the turbulent airflow 17 in the particulate removal chamber 2.

[0170] The coupling arrangement 4 is provided for removably attaching directly or indirectly (by means of an appropriate attachment) a suction apparatus to the particulate removal device 1. More in detail, the suction apparatus is a vacuum cleaner while the appropriate attachment is a vacuum cleaner hose, nozzle, or any other attachment of sufficient size to attach the suction source to the particulate removal device 1 via the suction source attachment aperture.

[0171] In particular, the coupling arrangement 4 comprises an opening 11 that is located on a third wall 12 of the device 1. Conveniently, the opening 11 is configured in shape and/or size to allow the attachment of a suction apparatus or an appropriate attachment thereof. In particular, the coupling arrangement 4 enables particulate to be removed from the particulate removal device 1 through the coupling arrangement 4 and into the suction apparatus. The opening 11 is annular and, preferably, is circular.

[0172] Advantageously, the coupling arrangement 4 is configured and designed in terms of shape and/or size to mate/couple with any vacuum cleaner either directly or indirectly via an intermediate appropriate attachment thereof. This makes the particulate removal device 1 universally accessible as it is capable of coupling with any commercially available vacuum cleaner.

[0173] Advantageously, the particulate removal device 1 is made from plastic.

[0174] Preferably, the particulate removal device 1 has a cuboid shape.

[0175] The particulate removal device 1 may consist of an extruded modulus unitary component or may consist of a plurality of co-operating components joined together, preferably in a detachable way, by means of fastening means (not shown) and receiving means 21. More in detail, the fastening means comprise nuts and bolt, screws, or any other traditional suitable means of fastening one component of the particulate removal device to another component of the particulate removal device in a predetermined location; more in detail, the receiving means 21 comprising bores or through-bores located at a predetermined site on either the main body of a component of the particulate removal device or an appropriate fixing tab thereof.

[0176] Preferably, the plurality of co-operating components comprises:

- a first component 30 defining the base portion of the cavity 19 of the particulate removal chamber 2,
- a second component 31 defining the top portion of the cavity 19 of the particulate removal chamber 2,
- a third component 32 defining the first wall 7 of the particulate removal device 1, and
- a fourth component 33 the second wall 8 of the particulate removal device 1.

[0177] Conveniently, the coupling arrangement 4 for the suction apparatus are defined in the first component 30, preferably on its underside face.

[0178] Conveniently, first component 30 is detachably joinable to the second component 31 so as to define the cavity 19 of the particulate removal chamber 2. In particular, these two components 30, 31 are joinable via inserting fastening means through receiving means 21 on the respective components so that they align in a co-operative predetermined way.

[0179] Ideally, the third component 32 defining the first wall 7 is detachably joinable to one side of the first 30 and second components 31 where is located an open end of the cavity 19 defining the chamber 2. In particular,

the joint is obtained by inserting appropriate fastening means into the receiving means 21 of the third component 32 and fastening them to the components 30, 31 defining the particulate removal chamber 2.

[0180] Ideally, the fourth component 33 comprises the second wall 8 provided with the elongate mouth 15 defining the exit aperture 6. In particular, the fourth component 33 is detachably joinable to another/opposite side of the first 30 and second components 31 where is located an open end of the cavity 19 defining the chamber 2. In particular, the joint is obtained by inserting appropriate fastening means into the receiving means 21 of the fourth component 33 and fastening them to the components 30, 31 defining the particulate removal chamber 2.

[0181] Advantageously, the particulate removal chamber 2 is designed so that either the third component 32 or fourth component 33 can be joined to either open end side of the cavity defining the chamber 2 and obtained by joining together the first 30 and second component 31. By incorporating universal coupling locations on third component 32 or fourth component 33 of the particulate removal device 1 and on the components 30, 31 defining the base and the top portions of the particulate removal chamber 2, the risk of incorrect assembly is eliminated. This is because it makes no difference which end of the particulate removal chamber 2 the third component 32 or fourth component 33 is joined since, once that one of the two components 32 or 33 is joined at one end of the chamber 2, the other component may be easily joined at the other end of the same chamber.

[0182] From the above disclosure, the advantages of the device are clear, since it allows to create a turbulent air 17 inside the chamber housing at least a portion of an elongate body 16 so that the particulates can be easily, quickly and suitably removed from the elongated body 16 without causing any damage to the surface aesthetic of the same elongate body 16, and in particular without leaving any surface scratches, abrasions or, in general, other damages.

[0183] In use an operator of the particulate removal device 1 couples a suction apparatus (not shown) to the suction apparatus coupling means 4 located on the third wall 12 of the device 1. The operator activates suction drawing air from inside the particulate removal chamber 2 to outside of the particulate removal chamber 2 and into the suction apparatus (not shown). Due to the configuration of the interior faces 13 of the particulate removal chamber 2 the generated suction stream 18 of the suction apparatus (not shown) is guided along at least a portion of the interior faces 13 of the chamber 2 drawing airflow into the suction apparatus (not shown). Furthermore, due to the portions of the interior faces 13 delimiting the particulate removal chamber 2 turbulent airflow 17 is created as air moves from a region proximal to the entry and exit apertures (5 and 6) of the device 1 and over the ridge projections 22 of the interior faces 13 of the chamber 2 into the suction stream 18 of the suction apparatus (not shown). An elongate body 16 is inserted into the device 1 via the entry aperture 5 passing through the particulate removal chamber 2 and in doing so passing through the generated turbulent air 17 within the chamber 2 towards the device exit aperture 6. During transit from the entry aperture 5 to the exit aperture 6 particulates are lifted away from the elongate body 16 by the turbulent air 17 into the suction stream 18 of the suction apparatus (not shown) to be removed from the particulate removal chamber 2. Upon exit from the chamber 2 the elongate body 16 is delivered up to a damping means (not shown). This damping means (not shown) dampens the loss of suction within the particulate removal chamber 2 upon the exit of the elongate body 16 from the particulate removal chamber 2. The damping means (not shown) further comprises textile material (not shown) to gently brush across the elongate body 16 surface to lift any residual particulates which were not previously dislodged by the turbulent airflow 17 when the portion of the elongate body 16 was within the particulate removal chamber 2 into the suction stream 18 of the suction apparatus (not shown) for removal.

[0184] In relation to the detailed description of the different embodiments of the invention, it will be understood that one or more technical features of one embodiment can be used in combination with one or more technical features of any other embodiment where the transferred use of the one or more technical features would be immediately apparent to a person of ordinary skill in the art to carry out a similar function in a similar way on the other embodiment.

[0185] In the preceding discussion of the invention, unless stated to the contrary, the disclosure of alternative values for the upper or lower limit of the permitted range of a parameter, coupled with an indication that one of the said values is more highly preferred than the other, is to be construed as an implied statement that each intermediate value of said parameter, lying between the more preferred and the less preferred of said alternatives, is itself preferred to said less preferred value and also to each value lying between said less preferred value and said intermediate value.

[0186] The features disclosed in the foregoing description or the following drawings, expressed in their specific forms or in terms of a means for performing a disclosed function, or a method or a process of attaining the disclosed result, as appropriate, may separately, or in any combination of such features be utilised for realising the invention in diverse forms thereof.

Claims

1. A particulate removal device for removing particulate from an elongate body, the device comprising: a particulate removal chamber configured to house at least a portion of an elongate body; an entry aperture configured to allow the at least a portion of the elongate body to enter the particulate removal chamber;

and coupling means for coupling the particulate removal chamber with a suction apparatus, wherein the particulate removal chamber is configured to create a turbulent airflow acting on at least one surface of the at least a portion of the elongate body so as to remove particulate from the at least one surface.

2. A particulate removal device as claimed in claim 1, wherein the device further comprises an exit aperture configured to allow the at least a portion of the elongate body to be removable from the particulate removal chamber.

3. A particulate removal device as claimed in claim 1 or claim 2, wherein the entry aperture and/or the exit aperture comprise an opening defined on a respective wall of the particulate removal device and an elongate mouth developing from the corresponding wall and connected/aligned with said opening.

4. A particulate removal device as claimed in claim 2 or claim 3, wherein the entry aperture is aligned with and directly opposite to the exit aperture

5. A particulate removal device as claimed in any one of the preceding claims, wherein the particulate removal chamber is configured for guiding airflow within and around the interior of the particulate removal chamber for removing particulate from the at least one surface of the at least a portion of the elongate body.

6. A particulate removal device as claimed in claim 5, wherein the particulate removal chamber comprises interior faces which delimit the particulate removal chamber and are shaped and sized to create, within the particulate removal chamber, a turbulent airflow that enables the removal of the particulate from the at least one surface of the at least a portion of the elongate body that is inserted and housed within the particulate removal chamber.

7. A particulate removal device as claimed in any one of the preceding claims, wherein the particulate removal chamber is configured for creating a turbulent air flow for extracting particulate from the at least one surface of the at least a portion of the elongate body on the application of a suction force provided by a suction apparatus.

8. A particulate removal device as claimed in claim 7, wherein the particulate removal device further comprises a dampening means to dampen the loss of suction provided by the suction apparatus.

9. A particulate removal device as claimed in any one of the preceding claims, wherein the particulate removal device comprises coupling means for a suction apparatus, said coupling means being configured for attaching a suction means or an appropriate attachment thereof to the particulate removal device.

10. A particulate removal device as claimed in any one of the preceding claims, wherein the particulate removal device consists of one modular unitary component.

11. A particulate removal device as claimed in any one of claims 1 to claim 9, wherein the particulate removal device consists of a plurality of co-operating components

12. A particulate removal device as claimed in claim 11, wherein the plurality of co-operating components comprise means for their reciprocal joining.

13. A suction system comprising a particulate removal device as claimed in any one of the preceding claims and a suction apparatus that is connected/attached to the particulate removal device via the suction apparatus coupling means.

14. A method of removing particulates from a body member by means of turbulent airflow within a particulate removal device, the method comprising the steps of: generating a suction force within the particulate removal chamber drawing air into the chamber so as to create the turbulent airflow; inserting at least a portion of the body member into the particulate removal chamber via an entrance aperture; and removing the at least a portion of the body member from the particulate removal chamber.

15. A method to remove particulates from an elongate body by means of turbulent airflow within a particulate removal device, the device having an entrance aperture and an exit aperture with a particulate removal chamber extending therein between, the particulate removal chamber having a corrugated surface, the method comprising the steps of: generating a suction force within the particulate removal chamber drawing air into the chamber so as to create the turbulent airflow; inserting at least a portion of the elongate body into the particulate removal chamber via the entrance aperture; and removing the at least a portion of the elongate body from the particulate removal chamber via the exit aperture.

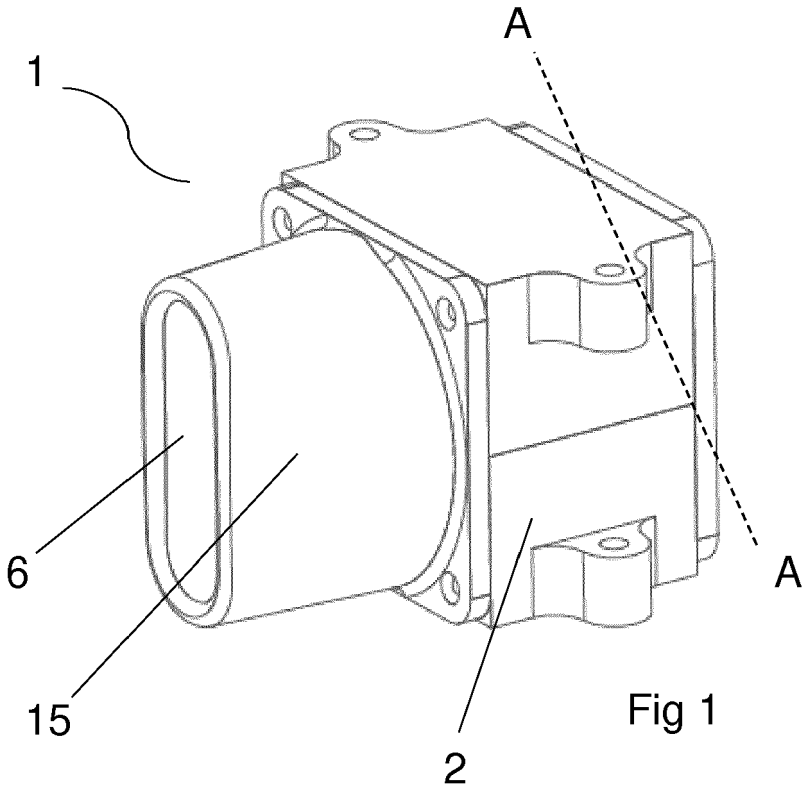


Fig 1

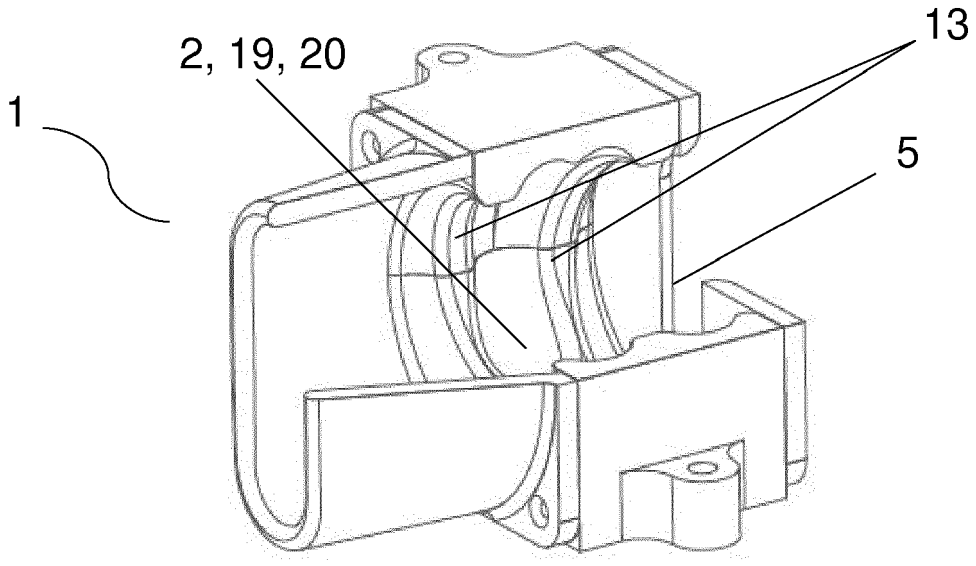


Fig 2

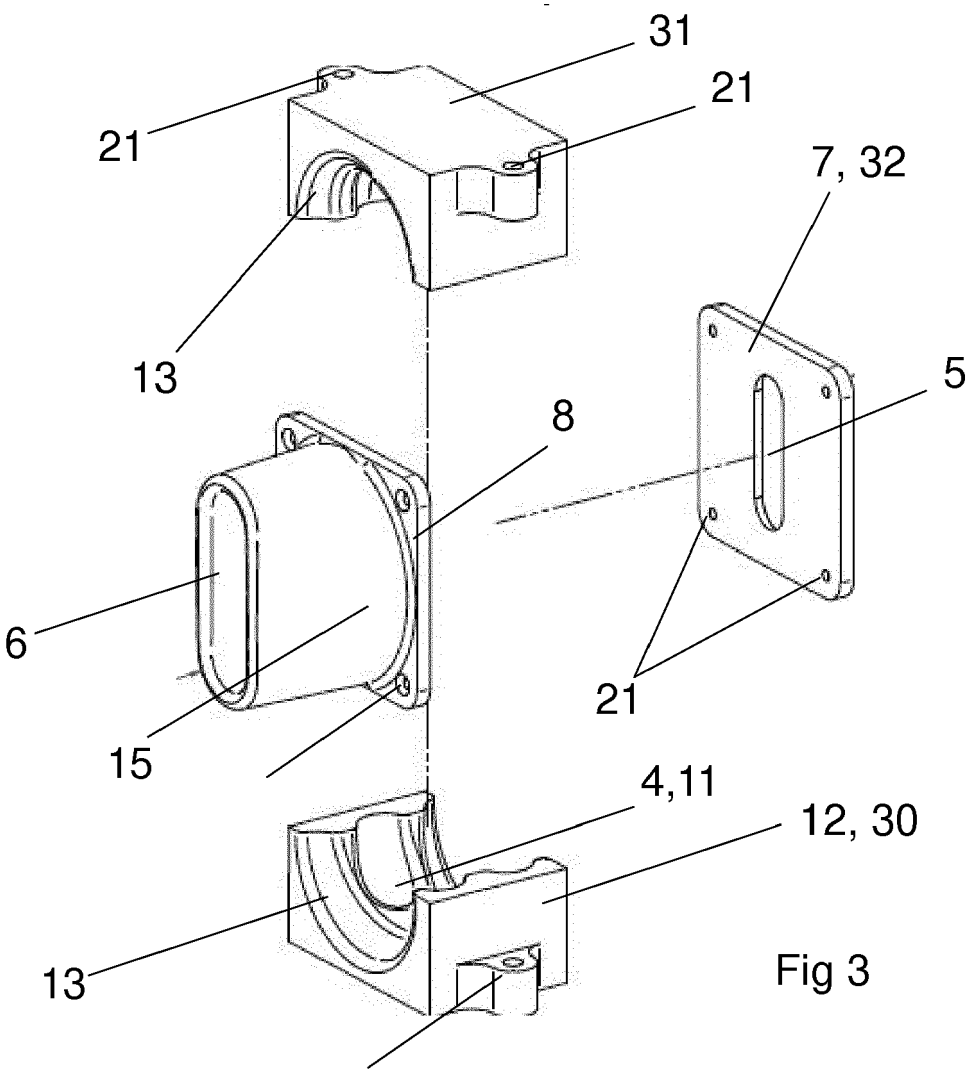


Fig 3

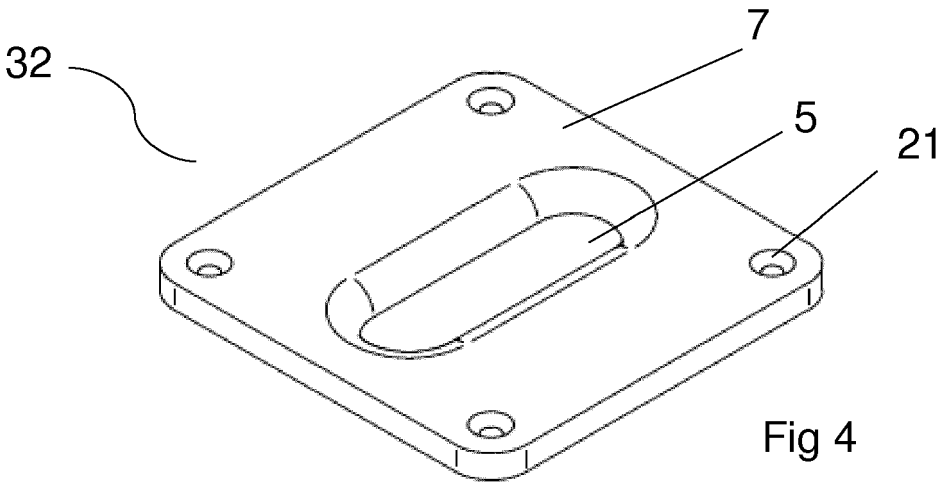


Fig 4

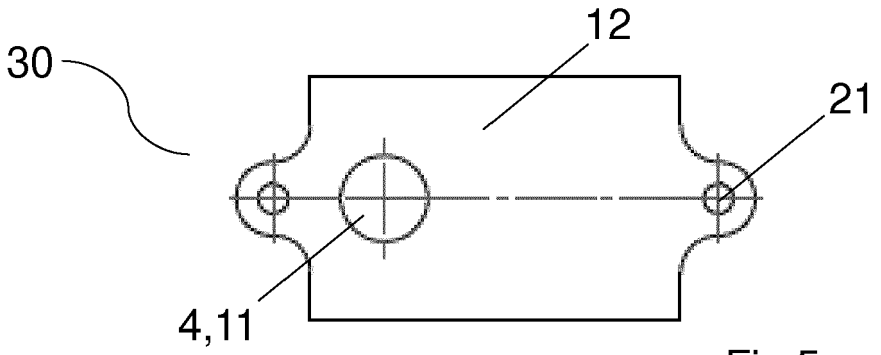


Fig 5

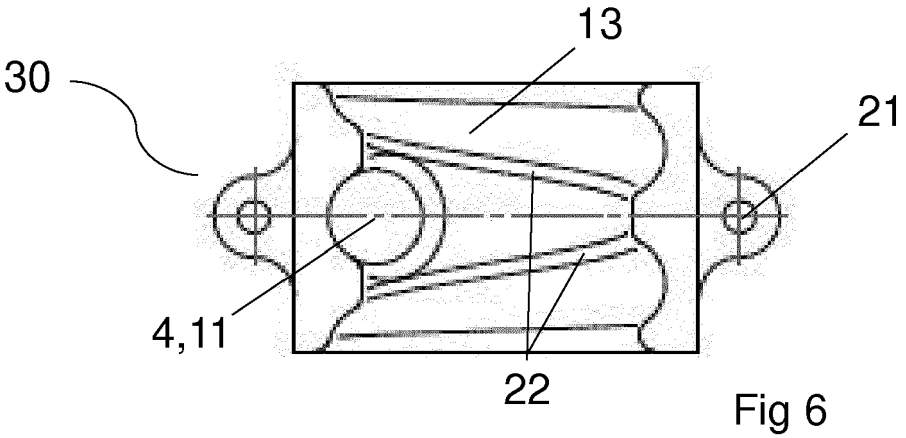


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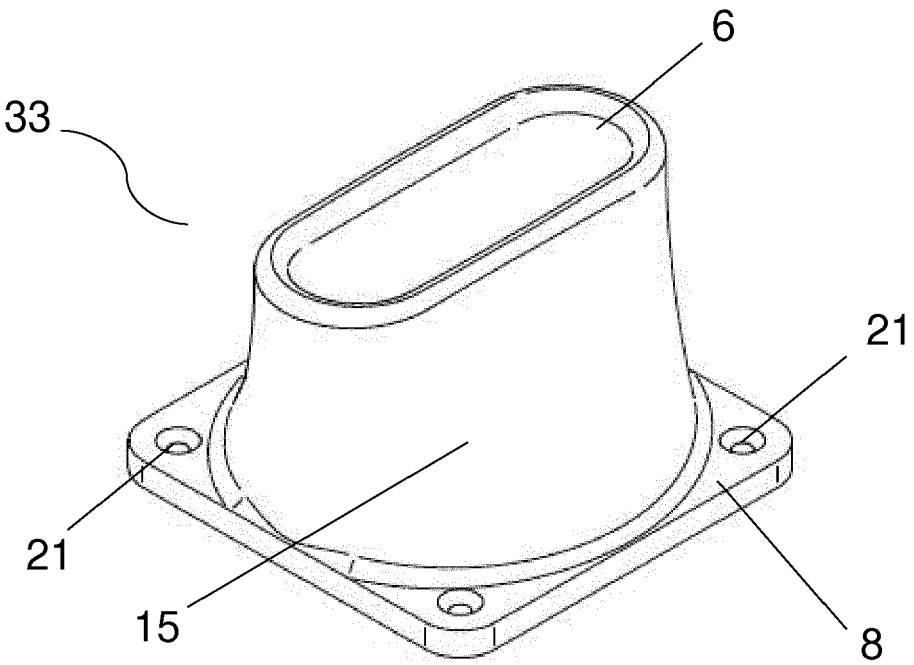


Fig 7

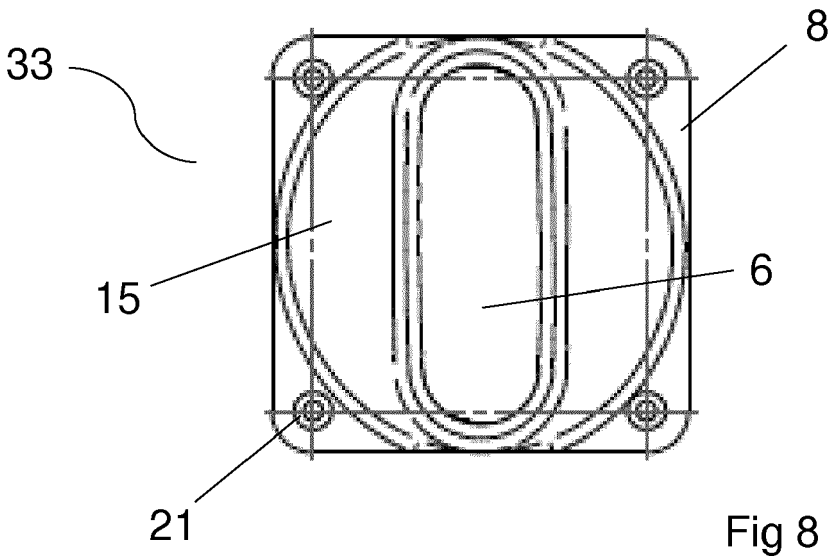


Fig 8

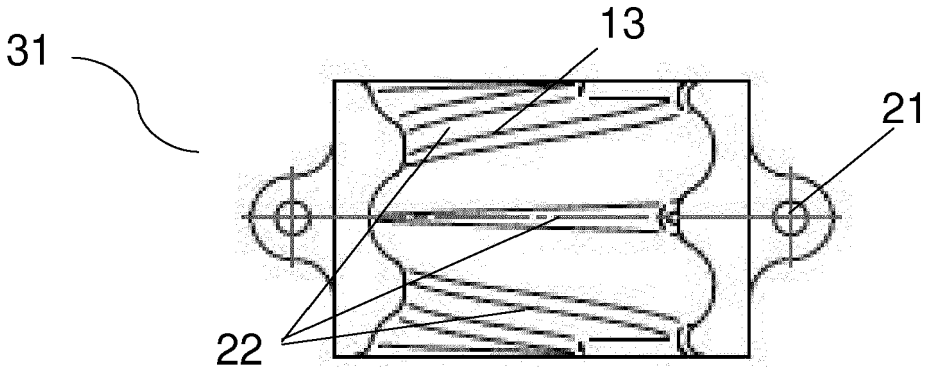


Fig 9

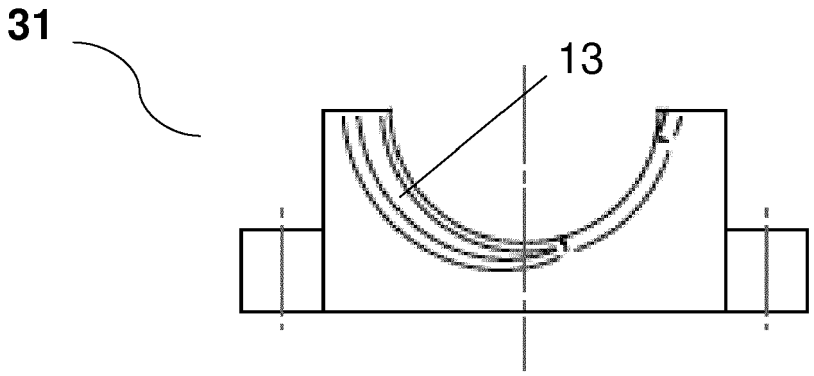


Fig 10

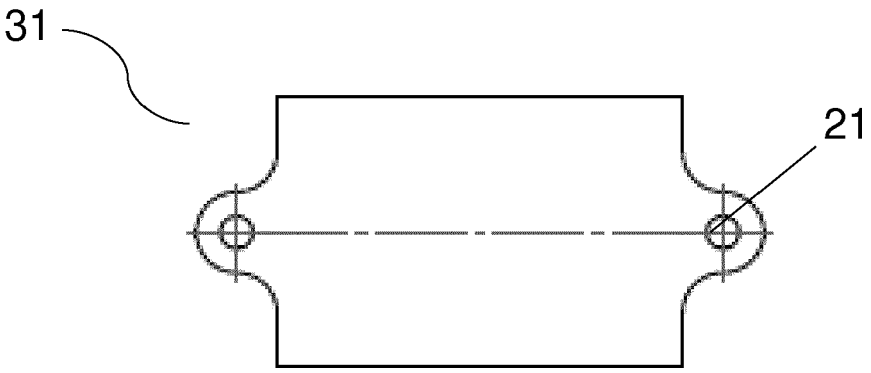


Fig 11

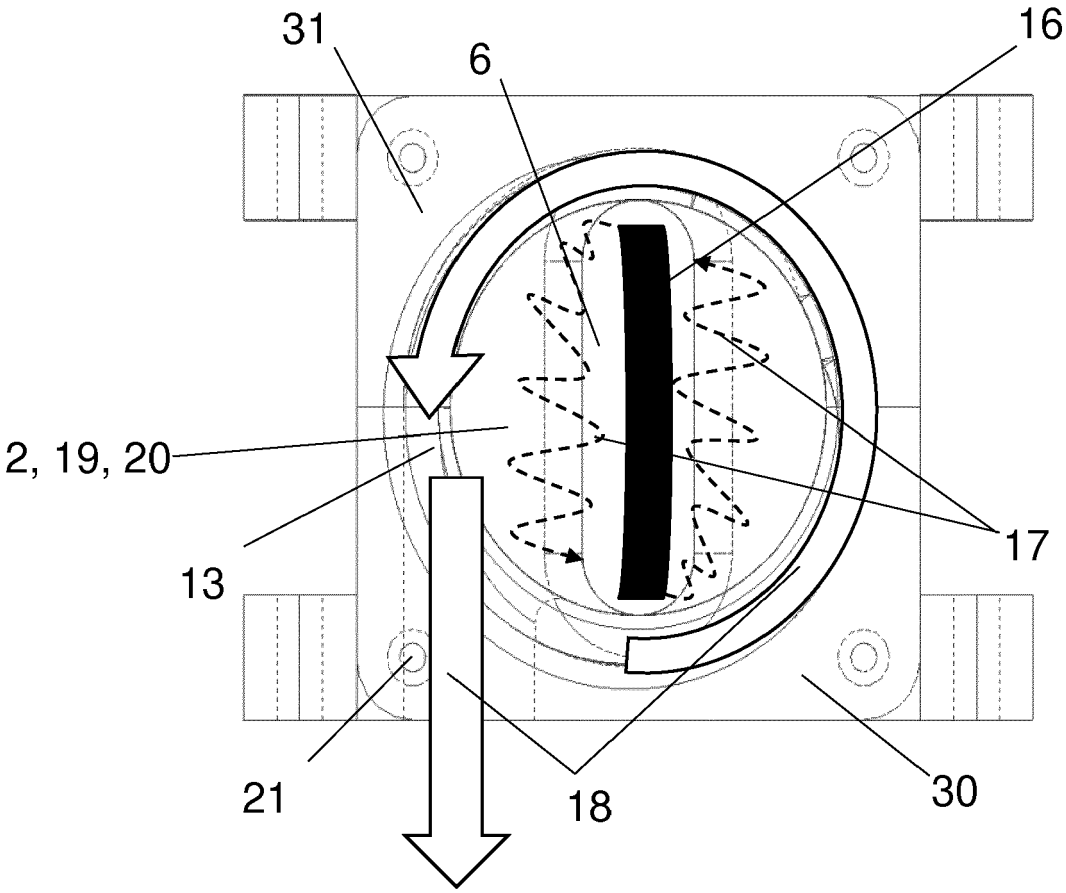


Fig 12

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 5756

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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	24 January 2020	van der Zee, Willem

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EUROPEAN SEARCH REPORT

Application Number
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