

(19)



(11)

EP 2 789 796 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.10.2014 Bulletin 2014/42

(51) Int Cl.:
E21C 35/22^(2006.01)

(21) Application number: **13162808.3**

(22) Date of filing: **08.04.2013**

(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

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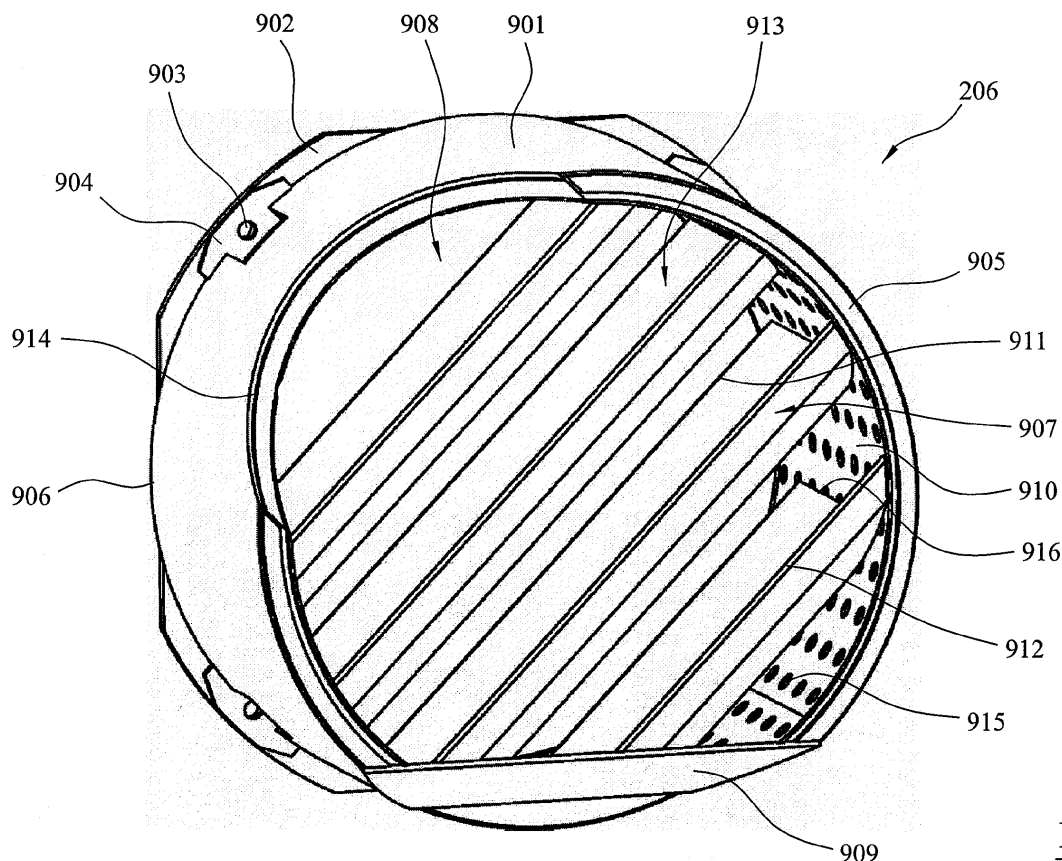
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(54) Mining machine filtering unit with sound absorber

(57) A dust filtering unit mountable at a mining machine (100) having an exhaust unit (114) to drive an air-flow stream through a filter duct (113). The filter unit also includes a silencer (206) positioned at an outlet region (508) of the exhaust unit (114) and configured to sup-

press noise emission from the exhaust unit. The silencer (206) comprises a plurality of internal directing vanes (913) configured to deflect the airflow stream at the exhaust of the filter unit away from a region immediately behind the mining machine.

**FIG. 9**

Description

Field of invention

[0001] The present invention relates to a dust filtering unit mountable at a mining machine, and in particular, although not exclusively, to a mining machine having an exhaust unit to drive a dust laden airflow through the filtering unit and a sound absorber coupled to the exhaust unit to dampen sound emission from the exhaust unit.

Background art

[0002] A variety of different methods and machines have been developed to extract minerals and other valuable materials at and below the Earth's surface. Such machines typically operate in mines at great depths.

[0003] In order to maximise excavation and mineral recovery efficiency, mining machines have been developed for specific purposes. Whilst some machines are configured exclusively to cut the mineral from a deposit or seam, other machines are configured to tunnel within the subterranean depth to effectively create the mine and provide passageways for the mineral cutters. In particular, mobile mining machines have emerged as successful apparatus to both provide direct cutting at the seam and as a means of rapid entry roadway development. Typically a mobile mining machine comprises a rotatable cutting or mining head having cutting bits provided on rotating drums to contact the mineral face. The cutting head is conventionally mounted at a moveable boom so as to be adjustable in height relative to the mine floor. As the cutting head is rotated and advanced into the seam, the extracted mineral is gathered and conveyed rearwardly by the mobile machine via conveying apparatus to create discharged stock piles for subsequent extraction from the mine.

[0004] As will be appreciated, as the cutting bits engage the mineral, such as coal, fine airborne particulate contaminants are created which pollute the environment surrounding the mining machine creating in turn a dangerous and harmful environment for mining personnel. Different methods and apparatus have been developed to control and in particular suppress such dust. One particularly successful approach involves a machine mounted filter unit that is configured to filter the dust laden air immediately behind the cutting head.

[0005] Example mining machines having dust collecting or filtering units are disclosed in US 3,387,889; US 3,712,678; US 3,743,356; US 5,597,393; GB 2263294 and EP 1486642.

[0006] Conventional filtering units for mining machines comprise a filtration duct having a scrubber unit and demister. An exhaust unit that comprises a fan and a silencer is coupled to the filter duct and drives the airflow through the scrubber and demister in an attempt to separate the air-entrained particulate contaminant and to exhaust a stream of purified air and collect the dust parti-

cles. Typically, the silencer is mounted at the outlet end of the exhaust unit to dampen the sound emission created by the fan and other moving components of the exhaust. The silencer conventionally comprises a drum-like body with a sound attenuation or absorbing material lined internally at the drum wall. EP 1503033 discloses a filter unit for a mining machine have a fan unit fitted with a silencer in an attempt to dampen noise emissions.

[0007] However, conventional filtering units having an outlet end mounted silencer are disadvantageous in that noise emission is suppressed or dampened to a large extent laterally to each side of the mining machine whilst the environment immediately behind the machine experiences significantly less noise reduction. This is principally due to the path and velocity of the filtered airflow stream carrying the sound waves to this rearward region. It is within this rearward environment where the majority of mining personnel would be located during normal use of the machine within a confined tunnel. There is therefore a need for a filter unit and in particular a sound absorber or noise reduction unit that addresses these problems.

Summary of the Invention

[0008] It is an objective of the present invention to provide a filtration unit for a mining machine configured to suppress and deflect sound emission from an exhaust unit (airflow drive component) of the filtering unit away from the region immediately behind the mining machine and mining personnel occupying this region.

[0009] The objectives are achieved by configuring the filtering unit with a sound absorber (typically referred to as a silencer) mounted at an airflow outlet of the exhaust unit and being configured to direct and channel the filtered airflow stream from the exhaust unit in a direction upwardly, downwardly or laterally to either side of the region immediately behind the filtering unit. In particular, the present sound absorber comprises a plurality of directing vanes mounted internally within the absorber body with each vane comprising a bent or curved region along its length to deflect the filtered airflow that is responsible for carrying the sound waves rearwardly of the filtering unit. The present absorber, via suitable attachment mountings at the exhaust unit is configured for adjustable positioning to achieve a desired direction of the deflected exhaust airflow pathway to suit a particular mining environment be this upwardly, downwardly or laterally to each side of a mining machine at its rearward end.

[0010] The present deflecting vanes preferably comprise a sound absorbing material to further reduce sound emissions. Additionally, the curved or bent regions are positioned directly in the airflow path and also act to suppress sound waves from exiting the outlet end of the absorber due to the incident angle of the filtered airflow stream onto the curved or bent regions.

[0011] Additionally, the present absorber is advantageous to further reduce noise emissions as the filtered

airflow stream is divided by the plurality of vanes. Furthermore, the curved or bent regions positioned towards the outlet end of each vane effectively shield or close the outlet end of the absorber when viewed from a region immediately behind the absorber. That is, when viewed from immediately behind, a significantly reduced area of the internal components of the exhaust unit (fan blades) are visible and therefore the available surface area at the outlet end of the absorber for the direct transmission of unobstructed or nondeflected sound waves is minimised. This is to be contrasted with existing silencer units where the fan blades are almost entirely visible from the exhaust outlet end.

[0012] According to a first aspect of the present invention there is provided a dust filtering unit mountable at a mining machine having a machine frame, the unit comprising: a filter duct having at least one filter to filter airborne contaminants generated by the machine, the filter duct having an inlet to receive an airflow containing the airborne contaminants and an outlet to discharge a filtered airflow; an exhaust unit to drive the airflow through the filter duct, the exhaust unit coupled to a region of the outlet of the filter duct via an exhaust unit inlet; a sound absorber having an inlet coupled to an exhaust unit outlet and an outlet to discharge the filtered airflow, the sound absorber configured to dampen sound emission from the exhaust unit; characterised by: a plurality of airflow directing vanes housed internally within the sound absorber and extending in a lengthwise direction between the absorber inlet and outlet; wherein each vane comprises a curved or bent region along its length and positioned towards or at the outlet of the absorber configured to deflect a path of the filtered airflow from the absorber outlet and away from a region immediately behind the filtering unit.

[0013] Preferably, the unit the curved or bent regions extend in a lengthwise third or half of a total length of each vane closest towards the sound absorber outlet. Preferably, the vanes comprise a plate-like configuration and extend internally substantially or completely across the sound absorber in a widthwise direction perpendicular to the lengthwise direction of each vane. Optionally, a curvature of the curved regions is in the range 30 to 60°, 40 to 50°, or more preferably is 45°.

[0014] Preferably, the sound absorber comprises a hollow drum-like configuration with an internal chamber defined by an absorber wall, a protective liner positioned internally of the absorber wall and around the vanes. Optionally, the protective liner is perforated.

[0015] Optionally, the vanes comprise a plate surrounded by a sound absorbing material and an outer skin surrounding the sound absorbing material.

[0016] Preferably, the unit comprises between 2 to 10, 2 to 8, 3 to 6 or 4 vanes.

[0017] Preferably, the vanes are substantially planar in a lengthwise first half of a total length of each vane closest towards the absorber inlet.

[0018] Optionally, the vanes are spaced apart from one

another internally across the absorber and wherein regions between the vanes are unobstructed by the curved or bent regions in a direction between the absorber inlet and outlet.

[0019] Optionally, the sound absorber comprises a drum-like configuration defined by an absorber wall wherein a diameter of the absorber is approximately equal to a diameter of a fan unit of the exhaust unit.

[0020] Preferably, the filtering unit further comprising a sound muffler configured to dampen sound emission from the fan unit, the muffler positioned axially intermediate the fan unit and the sound absorber.

[0021] According to a second aspect of the present invention there is provided a mining machine comprising: a main frame; a moveable boom pivotally attached to the main frame and mounting a cutting boom at one end; a filter support frame moveably attached to the main frame and configured to support a dust filtering unit, the dust filtering unit comprising: a filter duct having at least one filter to filter airborne contaminants generated by the mining machine, the filter duct having an inlet to receive an airflow containing the airborne contaminants and an outlet to discharge a filtered airflow; an exhaust unit to drive the airflow through the filter duct, the exhaust unit coupled to a region of the filter duct outlet; a sound absorber having an inlet coupled to an exhaust unit outlet and an outlet to discharge the filtered airflow, the sound absorber configured to dampen sound emission from the exhaust unit; characterised by: a plurality of airflow directing vanes housed internally within the sound absorber and extending in a lengthwise direction between the absorber inlet and outlet; wherein each vane comprises a curved or bent region along its length and positioned towards or at the outlet of the absorber configured to deflect a path of the filtered airflow from the absorber outlet and away from a region immediately behind the filtering unit.

Brief description of drawings

[0022] A specific implementation of the present invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a bolter miner machine configured for mineral cutting with simultaneous bolting and material conveying having a filtration unit fitted with an exhaust unit according to a specific implementation of the present invention;

Figure 2 is a perspective view of the filtration duct and exhaust unit attached to a filter unit frame according to a specific implementation of the present invention;

Figure 3 is a plan view of the filter unit components and support frame of figure 2;

Figure 4 is a side elevation view of the filtration unit

and filter unit support frame of figure 3;

Figure 5 is a side elevation view of the filtration duct and exhaust unit of figures 1 to 4 with the present silencer removed for illustrative purposes;

Figure 6 is a plan view of the filtration duct and exhaust unit of figure 5;

Figure 7 is a perspective view of a mounting bracket arrangement for the exhaust unit of figure 6 comprising a second flexible coupling;

Figure 8 is a cross section through the mounting bracket assembly of figure 7;

Figure 9 illustrates a rear perspective view of a sound absorber for positioning at an outlet end of an exhaust unit, the absorber having a plurality of deflecting vanes mounted internally according to a specific implementation of the present invention;

Figure 10 is a rear view of the sound absorber of figure 9;

Figure 11 is a cross section view through A-A of figure 10;

Figure 12 is a side elevation view of the sound absorber of figures 9 to 11; and

Figure 13 is a cross section view through B-B of figure 12.

Detailed description of preferred embodiment of the invention

[0023] The present filtration unit will now be described with reference to a preferred embodiment by way of example mounted upon a bolter miner being an electrically powered, track-mounted continuous mining machine designed to excavate roadways and install roof bolts simultaneously. Such mining machines comprise a series of cutter drums mounted on a hydraulically actuated frame to enable independent movement of the drums relative to a main frame and tracks. Accordingly, the present filtration unit is also movably mounted at the machine. The machine also comprises roof and rib bolters mounted on a stationary part of the main frame that can be operated throughout the cutting cycle.

[0024] Referring to figure 1, the mining machine 100 comprises main frame 101 that provides support for an undercarriage or chassis (not shown) that supports a pair of endless driven tracks (not shown) for propelling the machine 100 over the ground and along a seam or cutting face. Main frame 101 comprises a generally forward end 102 and a generally rearward end 103. A conveyor 104 extends substantially from forward end 102 to rearward

end 103 and is adapted to carry material dislodged from the cutting face for subsequent discharge and stock piling at a remote location optionally using additional conveying and mining apparatus. A movable boom 105 is pivotally mounted at one end to main frame 101 and comprises a second end 106 mounting a cutting boom 115 that in turn mounts a plurality of rotatable drums 107. Cutting bits 108 project radially from each drum 107 and are specifically adapted to cut into and dislodge the mineral material to be mined from a seam. Boom 105 and in particular end 106 is capable of being raised or lowered relative to main frame 101 and the endless tracks (not shown) to enable machine 100 to cut the seam face over a varying height range above the ground of the mine tunnel. Boom 105 is operated by hydraulic rams (not shown) and other associated components as will be appreciated by those skilled in the art. As indicated, conveyor 104 extends from the region of cutting boom 115 to a discharge end of machine 101 to efficiently transfer the cut material away from the cutting face.

[0025] To inhibit permeation of fine dust particles from the coal face created by the cutting action of bits 108 that pollute the air surrounding the mining machine 100, machine 100 comprises a dust filtering unit for collecting such airborne contaminants. The filtering unit comprises generally a series of ducts into which is drawn the contaminate-laden air for filtration and collection of the entrained dust particles. In particular, the filtration unit comprises a primary filter duct 113 comprising conventional filtering units. According to the specific embodiment, filter duct 113 houses a scrubber unit (not shown) positioned upstream of one or more demister units to effectively wet the contaminated airflow and then to separate the moistened airstream from the entrained dust particles. The contaminated airflow is drawn initially into the filter unit via an intake duct 112 positioned immediately behind cutting boom 115. The airflow through ducts 112 and 113 is driven by a hydraulic exhaust unit 114 located downstream and immediately behind filter unit 113. As illustrated in figure 1, the entire filtration unit 112, 113, 114 is supported by a filter unit frame 109 that is mounted generally at an upper region of main frame 101 and the mining machine 100. Filter unit frame 109 is in turn movably mounted via a machine actuating bracket 110 that comprises a number of pivoting sections and actuating rams 116 that enable bracket 110, frame 109 and filtration unit 112, 113, 114 to be raised and lowered in parallel with boom 105 so as to ensure air intake duct 112 is positioned at the appropriate height immediately behind the cutting boom 115. Boom 115 comprises a canopy section 115 positioned generally above intake duct 112. Canopy 111 comprises a generally planar configuration and is adapted for being raised vertically upward from frame 101 with bracket 110 to contact the mine roof to provide structural support as necessary during the cutting and roof bolting operations.

[0026] Referring to Figures 2 to 6 machine bracket 110 comprises a pair of arms 202 that extend either side of

filter support frame 109, filter duct 113 and exhaust unit 114. Each arm 202 is mounted at a first end to frame 101 via hydraulic rams 116. A second end of arms 202 is mounted at bracket canopy 111 positioned immediately above air intake duct 112. Duct 112 and in particular canopy section 111 is configured to pivot relative to filter duct 113 and bracket arms 202 via pivot mountings 203. Accordingly the pivot region 203 of the unit illustrated in figures 2 to 4 is raised and lowered relative to main frame 101 via actuation of rams 116 that in turn raises and lowers to varying degrees the filtration unit components 112, 113, 114.

[0027] Filter duct 113 is supported generally by filter frame 109 and intake duct 112 is suspended below and mounted at canopy 111 toward machine front end 102. Filter duct 113 is therefore positioned intermediate intake duct 112 and exhaust unit 114 in a lengthwise direction of machine 100 between forward and rearward ends 102, 103. Exhaust unit 114 is mounted at filter frame 109 via a set of mounting brackets 205 in the form of elongate plates that are bolted to and project rearwardly from a rearward end 204 of filter frame 109. In particular, exhaust unit 114 is suspended between elongate brackets 205 via a further pair of mounting brackets 201. Referring to Figures 3 and 4, the elongate brackets 205 are rigidly mounted to elongate support arms 300 that project rearwardly and are bolted to the rearward end 204 of frame 109 via mounting bolts 401.

[0028] As illustrated in figures 2 to 4, intake duct 112 comprises inlet 200 positioned immediately below a forward end of canopy 111 immediately behind rotatable cutting drums 107. An airflow outlet 400 of duct 112 is coupled in communication with an airflow inlet 301 of filter duct 113 positioned approximately below pivot regions 203. Filter duct 113 comprises an airflow outlet 302 provided in fluid communication with a forward end of exhaust unit 114.

[0029] Referring to Figures 5 and 6, filter duct 113 is mounted at frame 109 by a set of forward positioned attachments 500 and a set of rearward positioned attachments 501 that extend laterally each side of duct 113. Exhaust unit 114 comprises a fan connector section 503 having a generally cylindrical configuration. Section 503 is coupled directly to a hydraulic fan unit 504 also having a generally hollow cylindrical configuration with units 503, 504 bolted rigidly together. A sound absorber 505 (referred to herein a silencer or muffler) is positioned at a rearward second end of fan unit 504 and also comprises a generally hollow cylindrical configuration mounted axially with units 503 and 504 to provide a rigid unitary structure. The entire exhaust assembly 503, 504, 505 is mounted at the airflow outlet 302 of filter duct 113 via a flexible coupling 502. Coupling 502 comprises a generally tubular duct configuration having a relatively short axial length relative to units 503, 504, 505. Coupling 502 is formed from a resiliently deformable material and in particular rubber. A pair of annular mounting rims 506 project radially outward from and are mounted at each

axial end of the flexible coupling 502 to provide mounting regions with the adjacent upstream filter unit 113 and downstream fan connector section 503. Accordingly, exhaust unit 114 is non-rigidly attached to filter duct 113 via the axially intermediate and resiliently deformable elastic coupling 502.

[0030] Referring to figures 7 and 8, exhaust unit 114 is suspended from filter frame 109 generally by the pair of first mounting brackets 201 and a second pair of mounting brackets 205. With a further flexible coupling 703 positioned intermediate between brackets 201 and 205 so as to suspend exhaust unit 114 in a 'floating' configuration relative to support frame 109. The second brackets 205 comprise a pair of elongate plates 700 that extend parallel to one another and are spaced apart by a separation distance corresponding to slightly less than a diameter of the cylindrical exhaust unit 114. A pair of attachment plates 701 extend laterally from the outer edges of plates 700 and are orientated to be inclined upward from the upward facing planar surface of each plate 700. Each mounting plate 701 comprises a plurality of holes 703 to receive suitable attachment bolts for mounting at each rearwardly projecting frame arm 300 but is in turn rigidly bolted to end 204 of filter frame 109. First bracket 201 comprises a pair of substantially planar and rectangular plates 702 with each plate positioned vertically above a forward region of plate 700. Each first bracket plate 702 is mounted above each second bracket plate 700 via three deformable couplings 703 formed from a resiliently deformable material being rubber. In particular, three elastomeric and generally cylindrical bushings 703 are sandwiched intermediate between brackets 702 and 700. Accordingly, first bracket plates 702 are flexibly and elastically mounted at second bracket plates 700. An inner edge 707 of plate 702 extends radially inward of a corresponding inner edge 708 of plate 700 relative to a longitudinal axis of exhaust unit 114. Accordingly, exhaust unit 114 is accommodated within region 709 such that plate edges 707 are positioned in contact with and are rigidly welded onto an outer surface of the cylindrical fan unit 504. No other region of exhaust unit 114 is contacted by the mounting bracket arrangement of Figures 7 and 8. A sound dampening material 704, configured to reduce sound emission from fan unit 504, extends between and couples the lengthwise extending plates 700 and follows a generally curved part cylindrical path so as to sit immediately below the lower half region of exhaust unit 114. The forward and rearward ends of sound attenuation material 704 are bordered by an arcuate rigid cover 705 rigidly attached to each lengthwise edge of each plate 700 such that plates 700, material 704 and covers 705 define a part cylindrical, half drum-like configuration.

[0031] Accordingly, exhaust unit 114 via flexible coupling 502 is non-rigidly attached in an axial direction to filter duct 113 and is also non-rigidly mounted at filter frame 109 in a lateral sidewise direction via a set of second flexible couplings 703. Undesirable transmission of

body vibrations created by fan unit 504 considerably increases the noise emissions during operation of the exhaust unit 114. In the present configuration, the filtration unit and mining machine 100 is configured for reduced noise emission via elimination or inhibition of the transmission of vibrational forces from the fan unit 504 that would otherwise propagate to the filter unit 113 and filter frame 109. Accordingly, the present invention is configured to reduce noise emissions from fan unit 504 via the non-rigid and isolated mounting of the fan unit 504 relative to filter duct 113 and machine frame 100 (and in particular filter frame 109). That is, the axially positioned first coupling 502 is capable of both radial and axial elastic flexing to absorb any vibrational forces from fan unit 504. Additionally, the series of second flexible couplings 703 allow non-rigid and elastic flexing between the mounting brackets 201 attached rigidly to fan unit 504 and the brackets 205 attached rigidly to filter frame 109.

[0032] Referring to Figures 2 to 4, exhaust unit 114 further comprises a further sound absorber (silencer) 206 mounted at the exhaust end of sound absorber 205. Referring to Figures 5 and 6, fan unit 504 comprises an air flow inlet end 507 into which the purified airstream received from the filter duct 113 is received and an airflow outlet end 508 from which the exhausted and filtered airflow stream flows. Sound absorber 505 comprises an airflow inlet 509 (rigidly coupled to the outlet 508 of fan unit 506) and an outlet 510. The further sound absorber 206 of exhaust unit 114 is mounted at outlet 510 of intermediate sound absorber 505 attached directly to fan unit 504. According to the specific implementation, exhaust unit 114 comprises two silencer units 505 and 206 positioned downstream of fan unit 504 (and fan connector 503). However, according to further specific implementations, sound absorber 206 may be coupled directly to fan unit 504 via outlet 508.

[0033] Referring to Figures 9 to 13, sound absorber 206 comprises a generally drum-like configuration having an annular wall 910 that defines an internal chamber 908. Wall 901 comprises a first annular end 906 that defines an airflow inlet into chamber 908 and a second substantially annular end 905 that defines an airflow outlet from internal chamber 908. A plurality of mounting flanges 902 extend radially from first end 906 relative to a longitudinal axis 1200 extending through silencer 206. Two flanges 902 mount in turn a bracket 904 having an aperture 903 for rigid attachment of silencer 206 to intermediate silencer 505. A further flange 902 provides a mount for four brackets 904 each having a corresponding mounting aperture 903. Accordingly, silencer 206 may be rotated about axis 1200 and mounted at a plurality of different mounting positions about axis 1200.

[0034] Four airflow directing vanes 913 extend laterally across internal chamber 908 in a direction perpendicular to axis 1200. Each vane 903 is spaced apart from one another by a uniform separation distance so as to represent obstructions in the airflow path from inlet 906 to outlet 905. An inner liner 910 extends circumferentially

around wall 901 internally within chamber 208 and around directing vanes 913. Liner 910 comprises perforations 915 formed by small holes evenly distributed over the entire surface of liner 910. Liner 910 functions to protect directing vanes 913 from moisture and dust within the environment surrounding silencer 206.

[0035] Each directing vane 913 comprises a generally plate-like configuration being substantially planar over approximately one half of each vane 913 in the lengthwise direction between inlet 906 and outlet 905. That is, each vane 913 comprises a first end 911 positioned substantially at inlet 906 and a second end 912 positioned substantially at outlet 905. Each vane 913 comprises an inner skeleton formed by a steel plate 1100 being generally rectangular in shape. Each plate 1100 is encased by a sound absorbing material 1101 formed from a material configured to absorb or dampen propagation of sound waves to provide a sound absorbing characteristic. According to the specific implementation, material 1101 comprises Rockwool™ (available from Rockwool Ltd, UK) being a fibrous material. An outer skin 1102 surrounds the sound absorbing material 1101 such that each vane 913 comprises a composite structure configured to both direct air flowing through internal chamber 908 and to reduce noise emission created by fan unit 504. Each directing blade 913 is secured in the widthwise direction to inner liner 910 at each widthwise edge 916 using suitable attachment means secured to liner 910 and/or silencer wall 901. According to the specific implementation, each vane 913 is substantially planar in the widthwise direction between edges 916 perpendicular to axis 1200.

[0036] Each vane 913 comprises a curved region 907 formed in its trailing lengthwise half closest to the second end 912 and outlet 905. According to the specific implementation, the end region 907 of each vane 913 comprises a curvature of approximately 45° relative to longitudinal axis 1200. That is, section 907 represents a deflecting or airflow directing portion extending tangentially to axis 1200 so as to represent a region of greater obstruction to the airflow stream flowing within chamber 908 from inlet 906 to outlet 905. The vanes 913 are separated from one another by a distance such that a face 1103 of a first vane is separated from the curved end 1104 of a neighbouring vane 913 (in a direction perpendicular to axis 1200) by a predetermined distance. Accordingly, a narrow elongate slot is defined between neighbouring vanes 913 representing an unobstructed volume at the internal chamber 908 for the direct transmission of the airflow stream from fan unit 904 through silencer 906 when the exhaust unit 114 is viewed from directly behind at outlet end 905.

[0037] Sound absorber 206 comprises a curved cut-out region 914 formed in the cylinder wall 901 and ending axially inward through wall from the outlet rim 905 in a direction towards inlet rim 906. This region 914 functions to increase the surface area of the exhaust outlet 905 to compensate for the obstruction and hence decrease in

the available cross sectional area of outlet 905. By positioning this region 914 at the drum sidewall the exit airflow is further deflected at a lateral angle relative to axis 1200.

[0038] In use, the exhaust airflow from fan unit 504 is directed through internal chamber 908 to pass over the vanes 913. As the vanes 913 are substantially planar in a first half extending from first end 911, the airflow path is only slightly affected by the minimal obstruction represented by each flat plate like body 913 (at this first half region). However, as the airflow is incident upon the end region 907 of each blade 913, the flow path is deflected away from axis 1200 and exits outlet 905 at an angle corresponding approximately to the angle of curvature of each curved section 907. By adjustably mounting silencer 206 via brackets 904, the airflow exhausted from silencer 206 is directed upwardly, downwardly or laterally to either side of the region immediately behind machine end 103. This is advantageous to significantly reduce noise emission at this vicinity to protect mining personnel.

Claims

1. A dust filtering unit mountable at a mining machine having a machine frame, the unit comprising:

a filter duct (113) having at least one filter to filter airborne contaminants generated by the machine, the filter duct (113) having an inlet (301) to receive an airflow containing the airborne contaminants and an outlet (302) to discharge a filtered airflow;

an exhaust unit (114) to drive the airflow through the filter duct (113), the exhaust unit (114) coupled to a region of the outlet (302) of the filter duct (113) via an exhaust unit inlet (507);

a sound absorber (206) having an inlet (906) coupled to an exhaust unit outlet (508) and an outlet (905) to discharge the filtered airflow, the sound absorber (206) configured to dampen sound emission from the exhaust unit (114);

characterised by:

a plurality of airflow directing vanes (913) housed internally within the sound absorber (206) and extending in a lengthwise direction between the absorber inlet (908) and outlet (905);

wherein each vane (913) comprises a curved or bent region (907) along its length and positioned towards or at the outlet (905) of the absorber (206) configured to deflect a path of the filtered airflow from the absorber outlet (905) and away from a region immediately behind the filtering unit.

2. The unit as claimed in claim 1 wherein the curved or bent regions (907) extend in a lengthwise third or

half of a total length of each vane (913) closest towards the sound absorber outlet (905).

3. The unit as claimed in claims 1 or 2 wherein the vanes (913) comprise a plate-like configuration and extend internally substantially or completely across the sound absorber (206) in a widthwise direction perpendicular to the lengthwise direction of each vane (913).

4. The unit as claimed in any preceding claim wherein the sound absorber (206) comprises a hollow drum-like configuration with an internal chamber (908) defined by an absorber wall (901), a protective liner (910) positioned internally of the absorber wall (901) and around the vanes (913).

5. The unit as claimed in claim 4 wherein the protective liner (910) is perforated.

6. The unit as claimed in any proceeding claim wherein a curvature of the curved regions (907) is in the range 30 to 60°.

7. The unit as claimed in claim 6 wherein a curvature of the curved regions (907) is in the range 40 to 50°.

8. The unit as claimed any proceeding claim wherein the vanes (913) comprise a plate (1100) surrounded by a sound absorbing material (1101) and an outer skin (1102) surrounding the sound absorbing material (1101).

9. The unit as claimed in any proceeding claim comprising between three and six vanes (913).

10. The unit as claimed in any proceeding claim wherein the vanes (913) are substantially planar in a lengthwise first half of a total length of each vane closest towards the absorber inlet (906).

11. The unit as claimed in any proceeding claim wherein the vanes (913) are spaced apart from one another internally across the absorber (206) and wherein regions between the vanes are unobstructed by the curved or bent regions (907) in a direction between the absorber inlet (906) and outlet (905).

12. The unit as claimed in any proceeding claim wherein the sound absorber (206) comprises a drum-like configuration defined by an absorber wall (901) wherein a diameter of the absorber (206) is approximately equal to a diameter of a fan unit (504) of the exhaust unit.

13. The unit as claimed in claim (12) further comprising a sound muffler (505) configured to dampen sound emission from the fan unit (504), the muffler (505)

positioned axially intermediate the fan unit (504) and the sound absorber (206).

14. A mining machine (100) comprising:

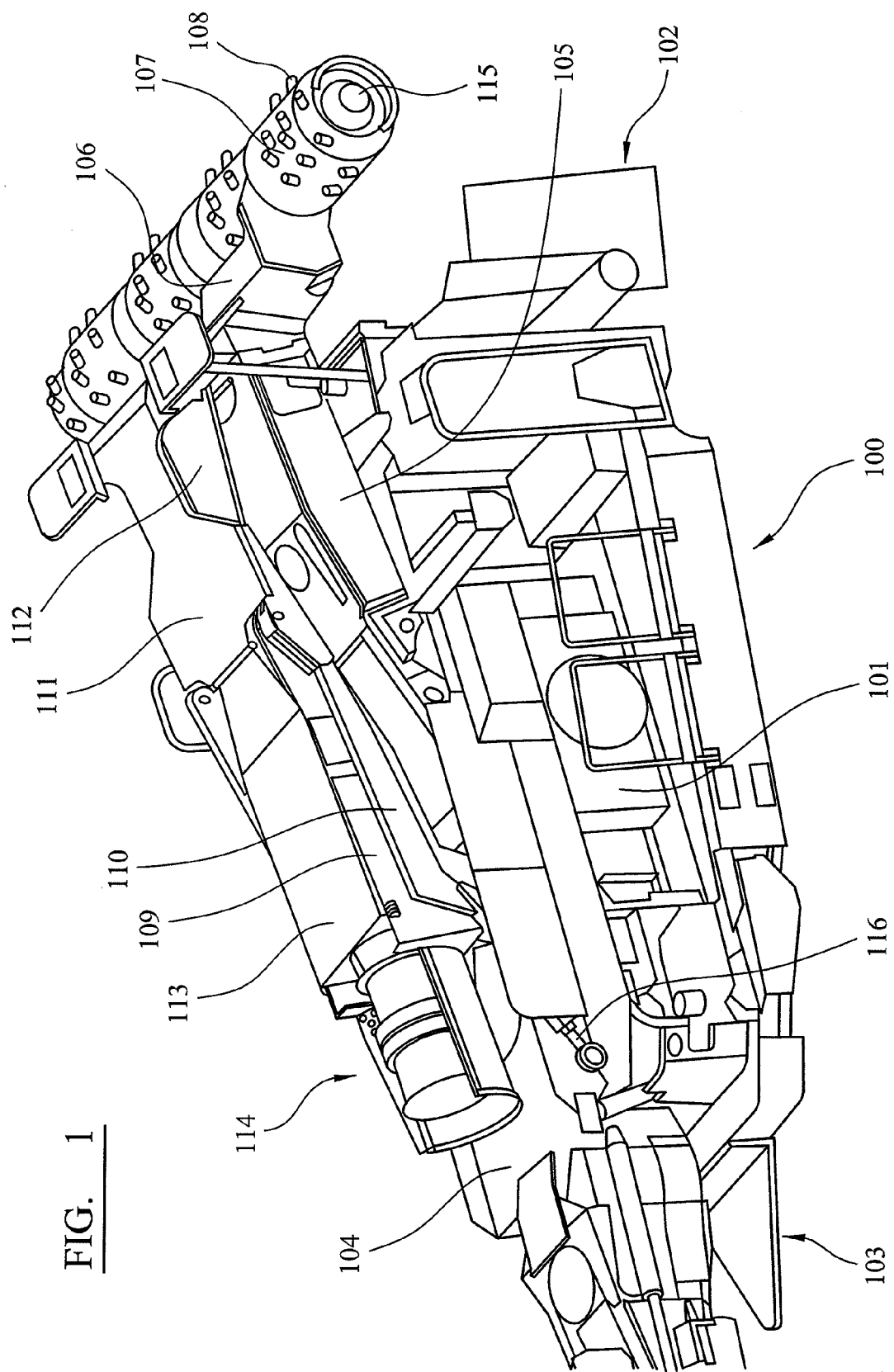
- a main frame (101);
- a moveable boom (105) pivotally attached to the main frame (101) and mounting a cutting boom (115) at one end (106);
- a filter support frame (109) moveably attached to the main frame (101) and configured to support a dust filtering unit, the dust filtering unit comprising:
 - a filter duct (113) having at least one filter to filter airborne contaminants generated by the mining machine, the filter duct having an inlet (301) to receive an airflow containing the airborne contaminants and an outlet (302) to discharge a filtered airflow;
 - an exhaust unit (114) to drive the airflow through the filter duct (113), the exhaust unit (114) coupled to a region of the filter duct outlet (302);
 - a sound absorber (206) having an inlet (906) coupled to an exhaust unit outlet (508) and an outlet (905) to discharge the filtered airflow, the sound absorber (206) configured to dampen sound emission from the exhaust unit (114);

characterised by:

- a plurality of airflow directing vanes (913) housed internally within the sound absorber (206) and extending in a lengthwise direction between the absorber inlet (906) and outlet (905);
- wherein each vane (913) comprises a curved or bent region (907) along its length and positioned towards or at the outlet (905) of the absorber (206) configured to deflect a path of the filtered airflow from the absorber outlet (905) and away from a region immediately behind the filtering unit.

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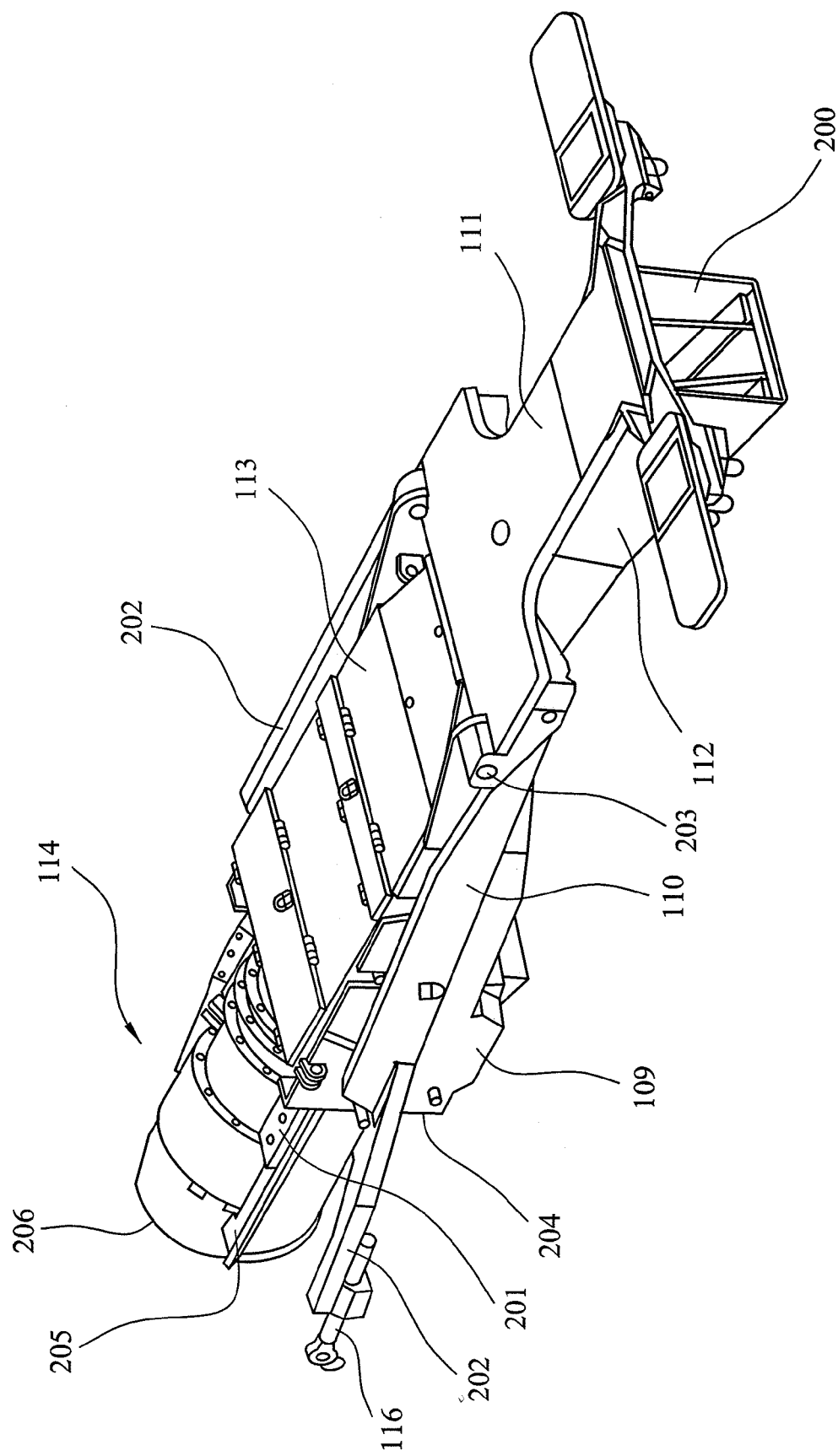


FIG. 2

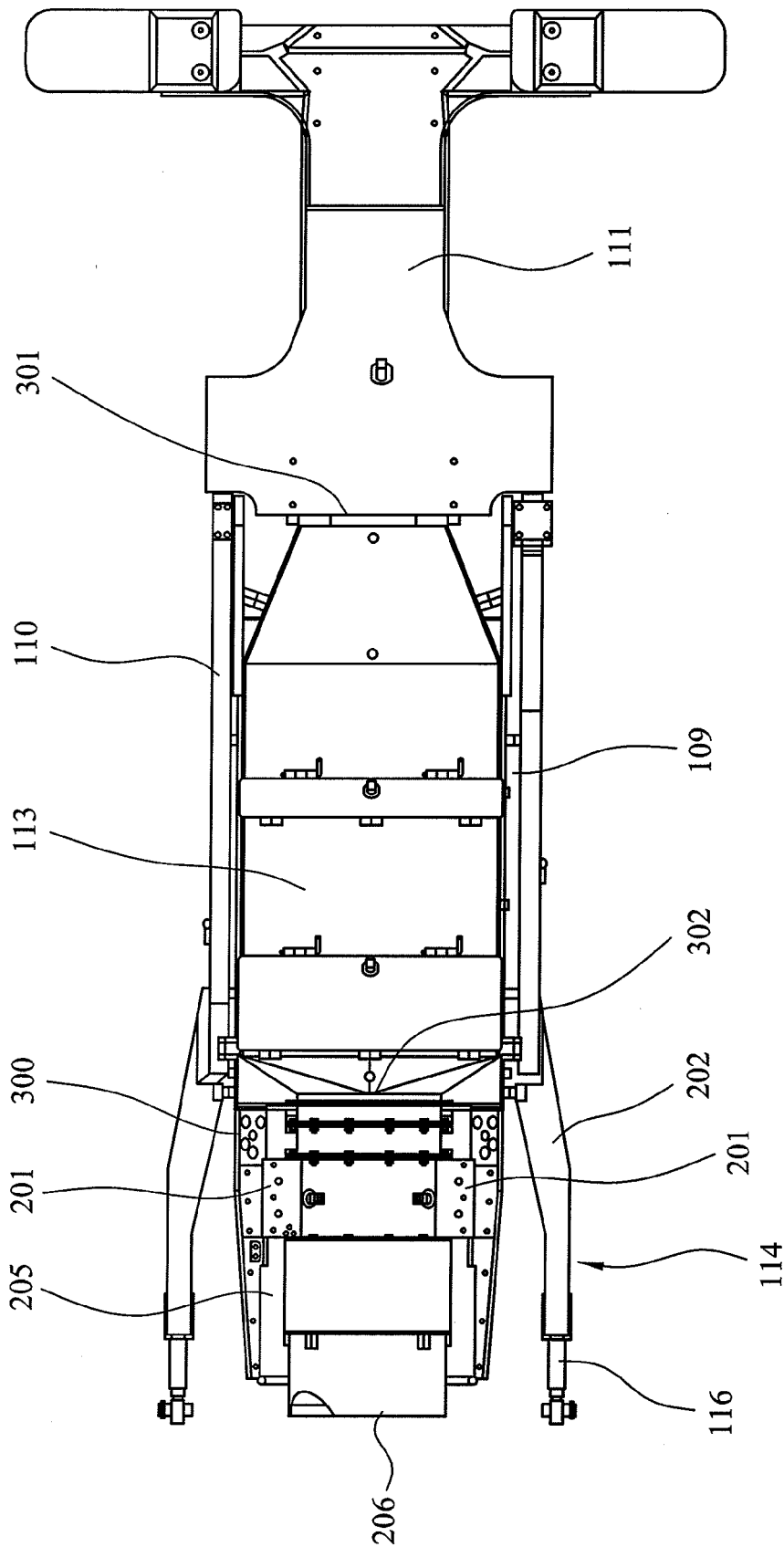


FIG. 3

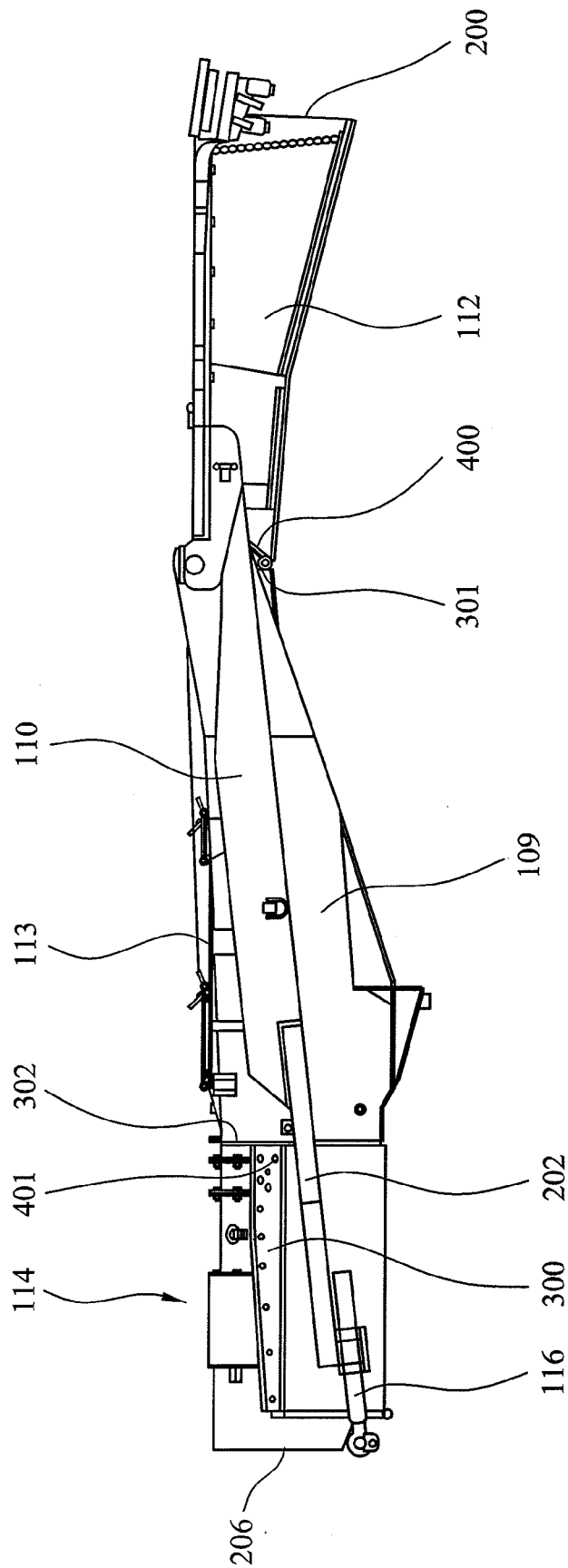


FIG. 4

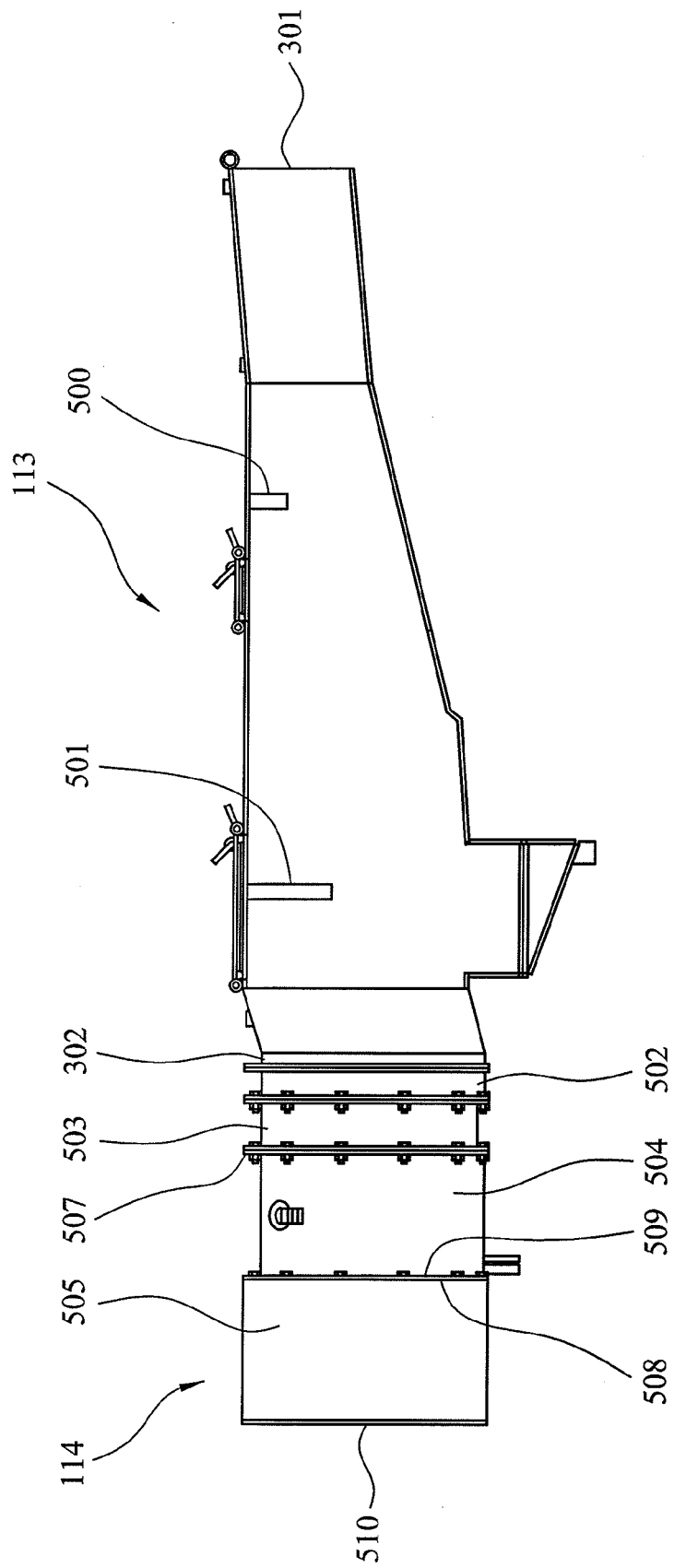


FIG. 5

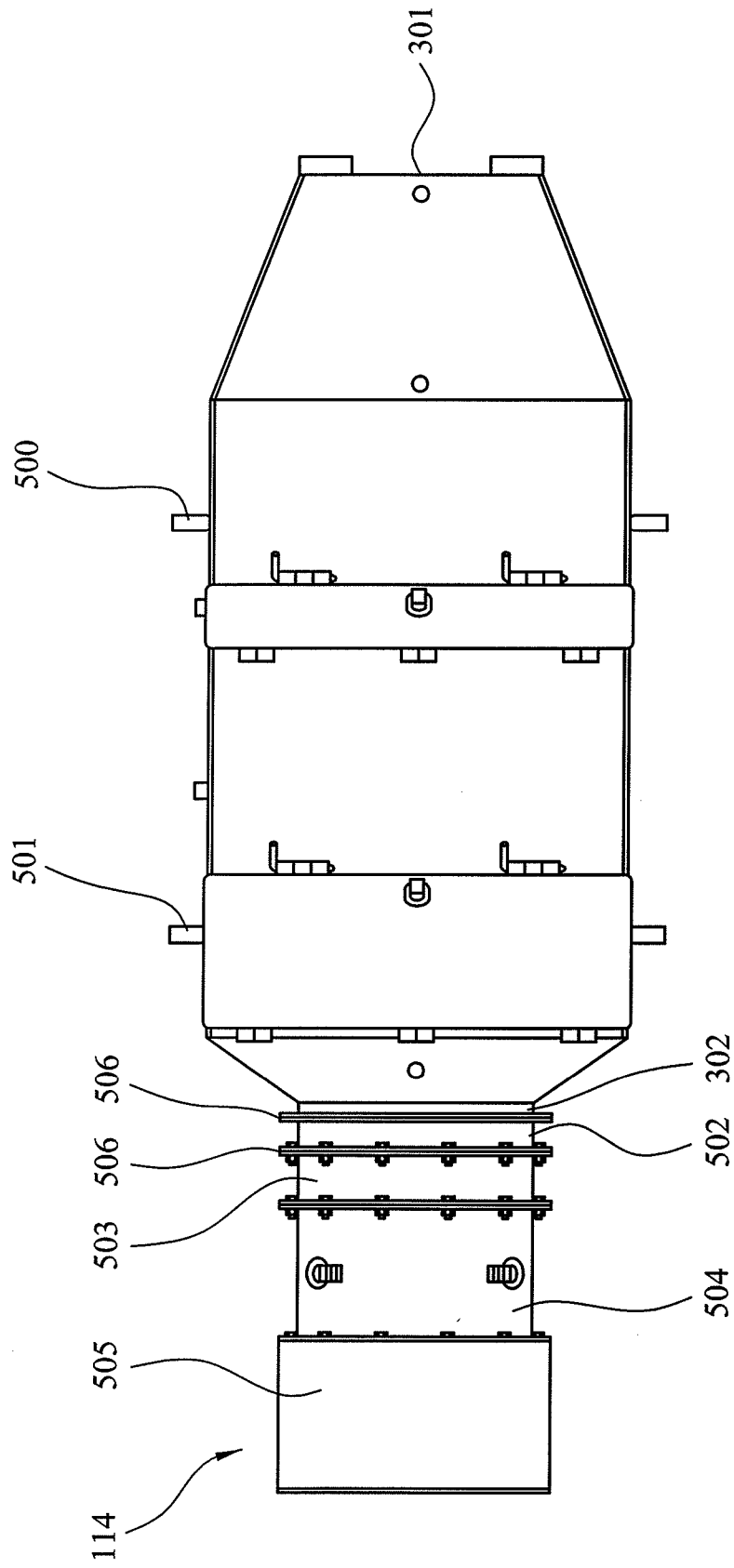
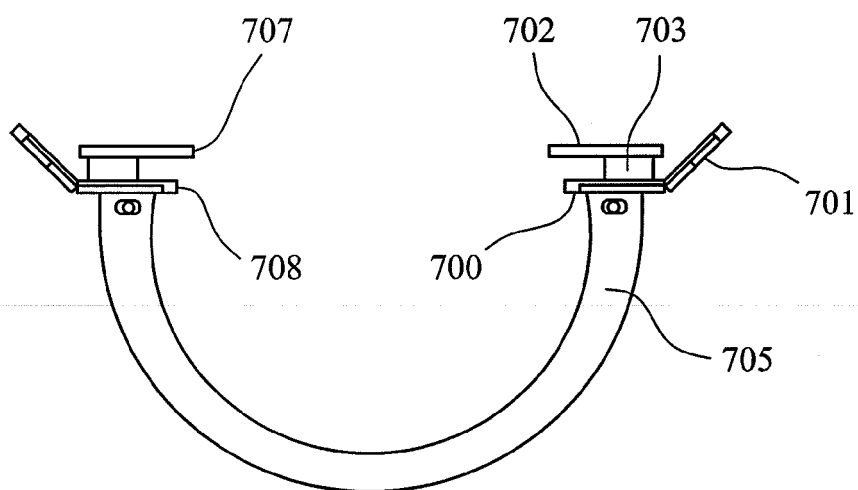
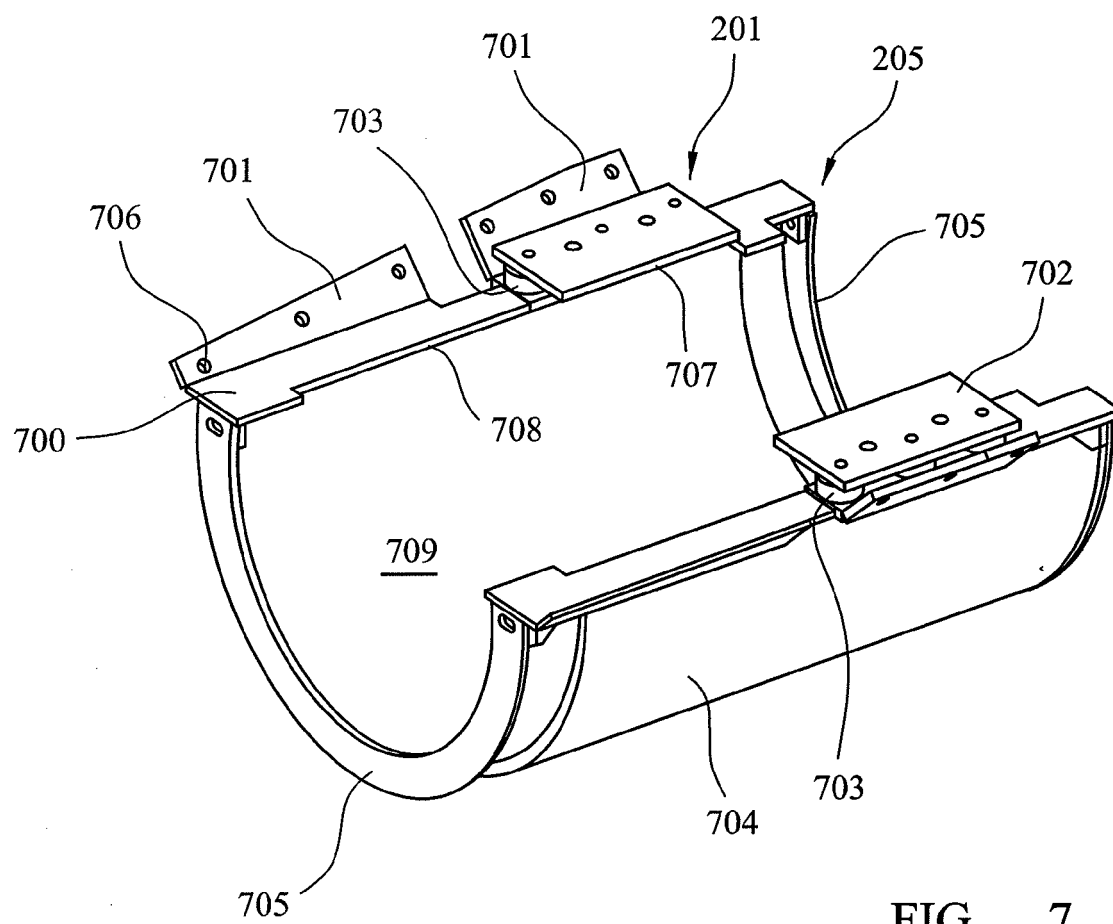


FIG. 6



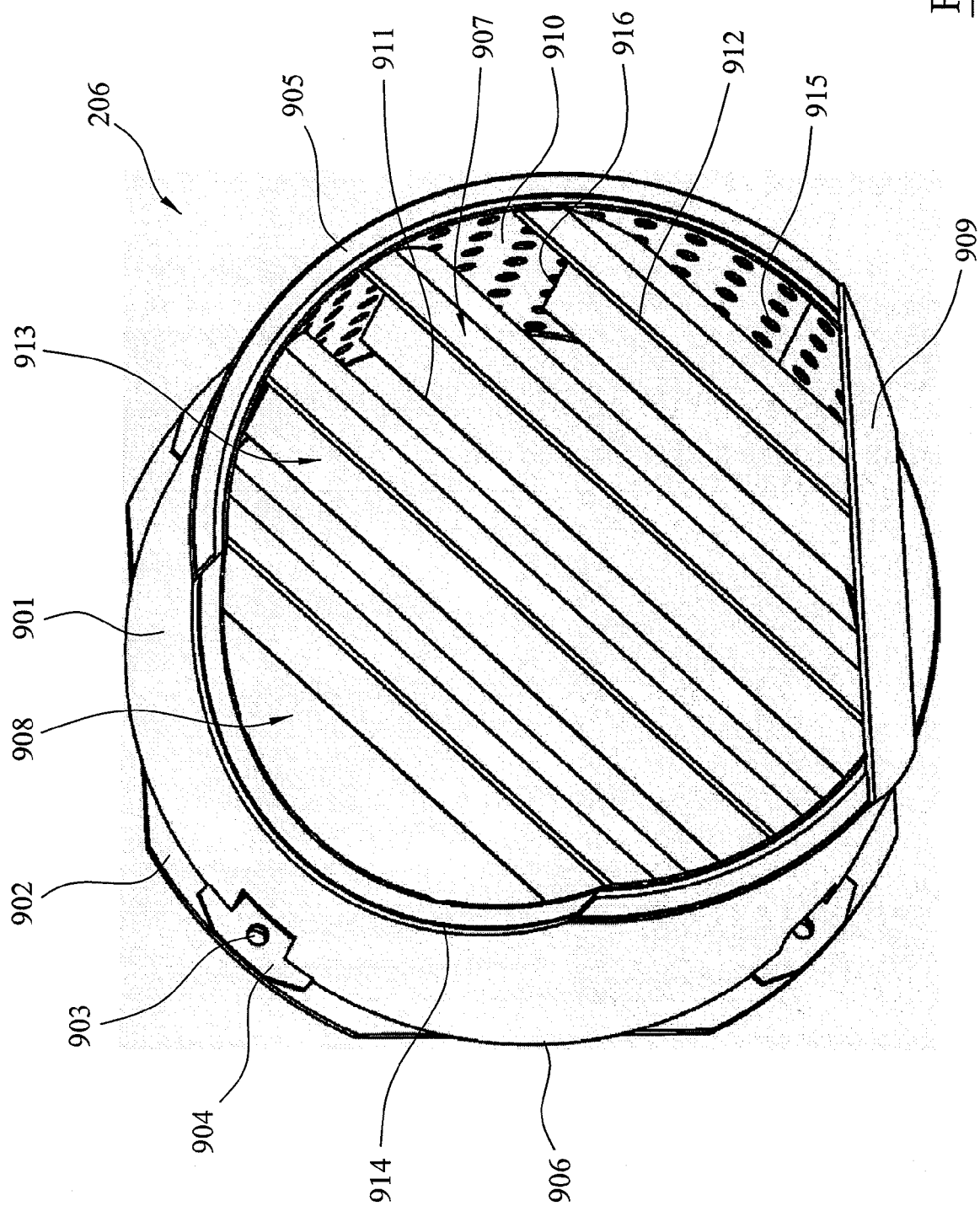


FIG. 9

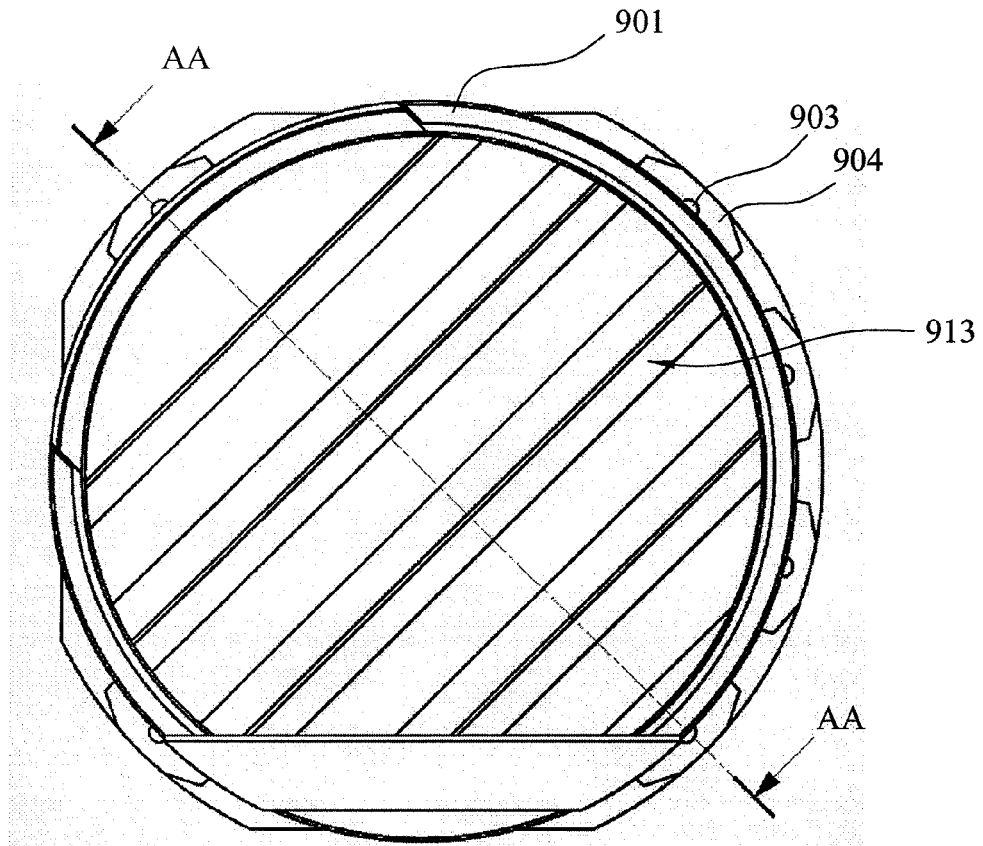
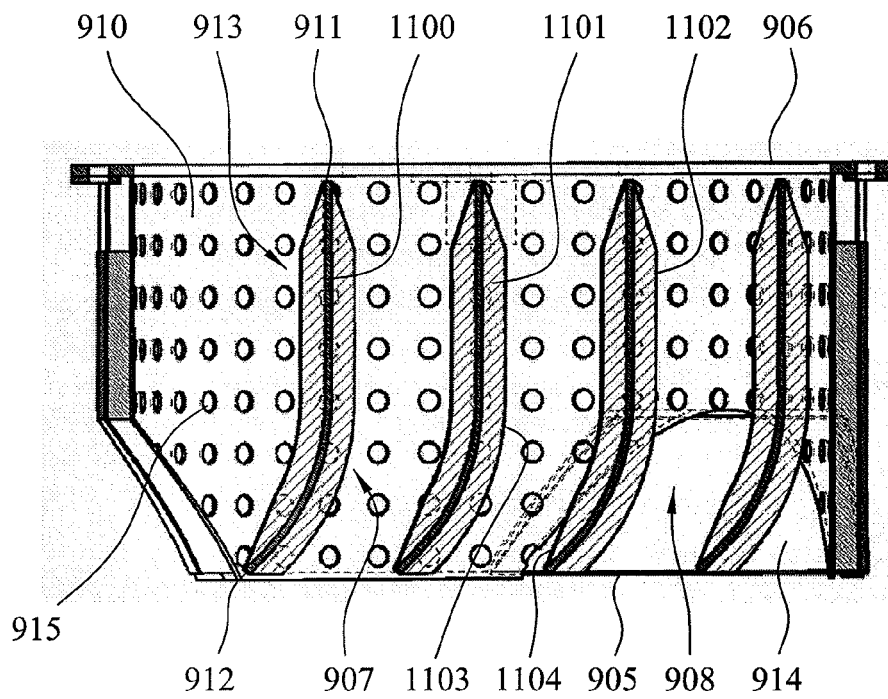


FIG. 10



SECTION AA - AA

FIG. 11

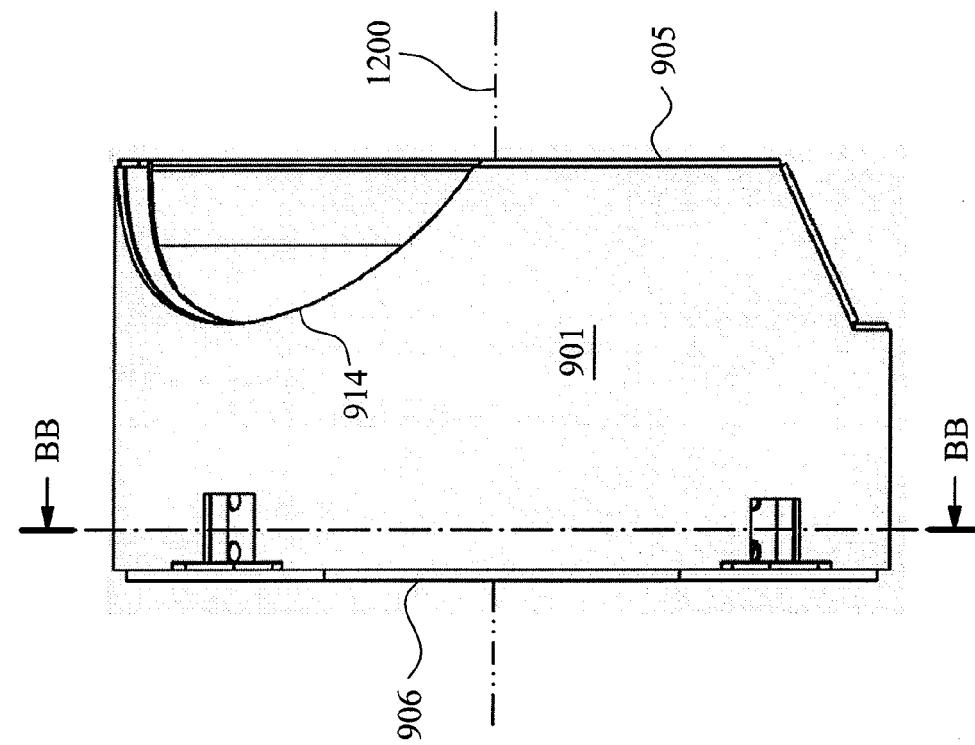
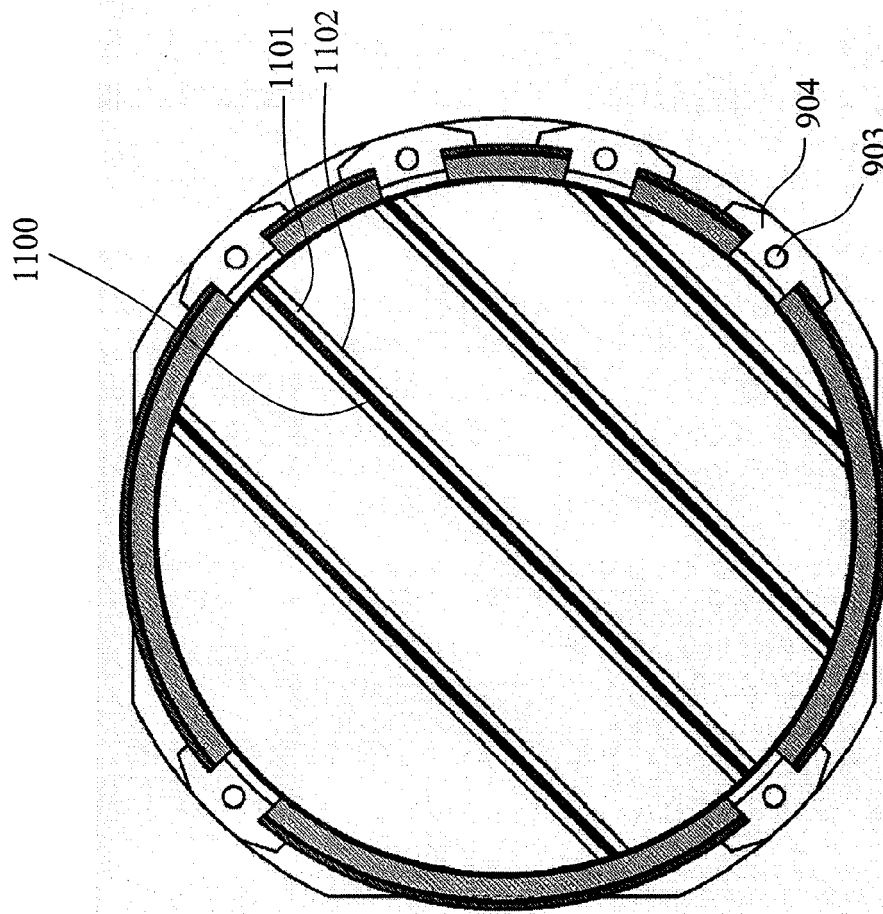


FIG. 12



SECTION BB - BB

FIG. 13



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