



## Description

**[0001]** This invention relates to a cleaner head and a cleaner apparatus.

**[0002]** A conventional cleaner head  $C_0$  of a cross-sectional configuration as shown in figure 7 is used (refer to Japanese Patent Provisional Publication No. 2011-45867).

**[0003]** That is to say, as shown in figure 7 and figure 8A, a dust-removed body 51 fed in an arrow K direction is a flat sheet, a flat panel, etc., a discharging slit 53 on a center and sucking slits 54 on an upstream and downstream sides in the feeding direction (the arrow K) are provided, and an interval dimension  $W_{54}$  of the sucking slits 54 is set to be sufficiently large. The interval dimension  $W_{54}$  is a dimension of mutual interval between center lines of the two slits 54 in the cross section shown in figure 9.

**[0004]** And, the dust-removed body 51 shown in figure 8B and figure 8C is a film (sheet body) supported by a backup roll 55 and fed in the arrow K direction, and a corresponding face 56 of the cleaner head  $C_0$  is formed into a concave face of a low trapezoid or arc to keep the interval dimension between the sucking slit 54 and the dust-removed body 51 under a predetermined value.

**[0005]** As described above, in the conventional cleaner head  $C_0$ , various cleaner heads, having the corresponding face 56 appropriate for each of the configurations of the dust-removed faces of the dust-removed body 51, are necessary.

**[0006]** Therefore, the inventors of the present invention had an idea that the interval dimension  $W_{54}$  in the conventional cleaner head  $C_0$  composed of an extruded section of aluminum as shown in figure 7 be shortened, and considered a cleaner head  $C_1$  (as a comparison example) shown in figure 9.

**[0007]** That is to say, the inventors thought that the interval dimension  $W_{54}$  of the sucking slits 54 can be reduced (in comparison with figure 7) as shown in the comparison example in figure 9, and the cleaner can be applied to the dust-removed body 51 such as a sheet body supported by the backup roll 55.

**[0008]** However, it was revealed that the interval dimension  $W_{54}$  can't be sufficiently small because the cleaner head  $C_1$  is composed of an extruded section of aluminum in figure 9 (comparison example).

**[0009]** Concretely, in figure 9, a pressurized space 59 on the center and left and right vacuum spaces 60 are formed by a rectangular surrounding wall 57 and two bent dividing walls 58 within the surrounding wall 57, and, it is difficult to make an interval dimension  $W_a$  of a near discharging portion 59A of the pressurized space 59 near the discharging slit 53 small as shown in figure 9.

**[0010]** The reason is the difficulty of making a part of a core of an extrusion die thin as to form the small interval dimension  $W_a$  shown in figure 9. That is to say, when the part of the core of the extrusion die is formed thin as the interval dimension  $W_a$ , the core is damaged and

abraded early in extrusion.

**[0011]** Further, the interval dimension  $W_a$  in figure 9 can't be made sufficiently small because the thickness of the extruded dividing wall 58 itself is difficult to be thin.

**[0012]** Therefore, it is an object of the present invention to provide a cleaner head and a cleaner apparatus which can be commonly used for dust-removed bodies of which dust-removed faces are straight and arc-convex in cross section.

**[0013]** This object is solved according to the present invention by cleaner head including features of claim 1 or claim 2 and a cleaner apparatus including features of claim 4.

**[0014]** The present invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view showing an embodiment of a cleaner head and a cleaner apparatus relating to the present invention to explain a used state;

Figure 2 is a cross-sectional view showing an extruded section before a discharging slit and sucking slits are worked;

Figure 3 is a cross-sectional view for explanation in which dimensions are indicated;

Figure 4 is a cross-sectional view of an enlarged principal portion in used state;

Figure 5 is a schematic view to explain a method of use of the present invention;

Figure 6 is a cross-sectional view showing another embodiment;

Figure 7 is a cross-sectional view showing a conventional example;

Figure 8A is a schematic explanatory view showing a conventional example;

Figure 8B is a schematic explanatory view showing a conventional example;

Figure 8C is a schematic explanatory view showing a conventional example; and

Figure 9 is a cross-sectional explanatory view showing a comparison example.

**[0015]** Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

**[0016]** In figure 2, an extruded section 1 composed of metal such as aluminum is shown. The extruded section 1 has a surrounding outer wall portion 11 rectangular in cross section and a pair of dividing inner wall portions 12 as one unit.

**[0017]** In figure 1 and figure 3, a cleaner head 30 relating to the present invention is shown. The cleaner head 30 is made by opening a discharging slit 6 and two sucking slits 7 on the extruded section 1 in figure 2 by machine work, etc. The pair of dividing inner wall portions 12 divides an inner space of the rectangular surrounding outer wall portion 11 into a pressurized space  $P_0$  and vacuum spaces  $V_0$ .

**[0018]** As described above, in figure 1 through figure 3, the inner space is divided into the pressurized space  $P_0$  on the center and the left and right vacuum spaces  $V_0$  by the dividing inner wall portions 12.

**[0019]** The surrounding outer wall portion 11 of which cross-sectional configuration is laterally long flat rectangular composed of a side (first horizontal face portion) 11A disposed to face the dust-removed face 10, another side (second horizontal face portion) 11B parallel to the side 11A, a left side (vertical left face portion) 11C, and a right side (vertical right face portion) 11D.

**[0020]** And, the dividing inner wall portion 12 has a vertical portion 12A and an inclined portion 12B of which cross-sectional configuration is bent "L" shaped. As shown in figure 2, two vertical portions 12A are suspended from the other side (upper side) 11B with right angles, and the inclined portions 12B are bent from a vertically middle position as to come close each other.

**[0021]** An angle  $\theta$  formed by the inclined portion 12B and a central vertical line  $L_c$  is  $30^\circ$  to  $50^\circ$ . The angle  $\theta$  is preferably  $35^\circ$  to  $45^\circ$ .

**[0022]** To describe further, the pair of left and right dividing inner wall portions 12 has a cross-sectional configuration in which the dividing inner wall portions 12 are (mutually) approaching from the vertically middle position as to form a predetermined angle  $2\theta$  of  $60^\circ$  to  $100^\circ$  (preferably  $70^\circ$  to  $90^\circ$ ), and, confluent with and connected to the side (first horizontal face portion) 11A. A mark G indicates a confluent position where the inclined portions 12B of the pair of the left and right dividing inner wall portions 12 and the side (first horizontal face portion) 11A are connected.

**[0023]** As shown in figure 2, an R-shaped thick portion 13 is formed on a corner portion formed by the inclined portion 12B and the side 11A.

**[0024]** On the above-described confluent position G, the discharging slit 6 to jet high-pressured air in the pressurized space  $P_0$  is opened. That is to say, the discharging slit 6 of narrow width dimension  $\varepsilon$  is formed along the central vertical line  $L_c$ .

**[0025]** And, as shown in figure 4 and figure 3, a pair of the sucking slits 7 to suck the air (after dust removing including dust separated and removed from the dust-removed face 10) into the vacuum spaces  $V_0$  is formed parallel to each of the inclined portions 12B of the pair of dividing inner wall portions 12 mutually approaching with the predetermined angle  $2\theta$ .

**[0026]** That is to say, each of the sucking slits 7 is opening parallel to the inclined portion 12B. Therefore, the angle formed by the pair of sucking slits 7 is  $2\theta$ . And, the sucking slits 7 are disposed line symmetric each other with respect to the central vertical line  $L_c$ .

**[0027]** To explain the construction of the present invention again with another expression, the above-described side (first horizontal face portion) 11A can be called a corresponding wall portion 15 facing the dust-removed face 10.

**[0028]** And, as shown in figure 4, in the cleaner head

30 having the discharging slit 6 opening in the direction at right angles with the corresponding wall portion 15 and the pair of sucking slits 7 opening near the upstream side and the downstream side of the discharging slit 6, outer extended lines  $L_7$  of the pair of sucking slits 7 opening on the corresponding wall portion 15 are inclined against the corresponding wall portion 15 as to mutually come close and intersect as departed from the corresponding wall portion 15.

**[0029]** As shown in figure 4, the outer extended lines  $L_7$  are lines along the center of the slit width of each of the sucking slits 7, mutually come close with the angle of  $2\theta$  and intersect on a position of an asterisk 25 (in figure 4).

**[0030]** And, as shown in figure 4, the sucking slit 7 has inner faces 7S facing mutually parallel, and, each of the inner faces 7S has a cross sectional configuration of straight line and reaches for a flat outer face  $P_{15}$  of the corresponding wall portion 15 keeping the straight line.

**[0031]** Therefore, an acute-angled edge 17 and an obtuse-angled edge 18 are formed (as shown in figure 4) on an opening end portion 7P on which the sucking slit 7 opens on the lower face of the corresponding wall portion 15 (the first horizontal face portion 11A). Therefore, when observed from a lower side of figure 4, the opening end portion 7P of each of the sucking slits 7 is observed as a straight groove of small width.

**[0032]** And, it can be said that the sucking slit 7 immediately opens on the horizontal face portion 11A with the edges 17 and 18.

**[0033]** Next, a cleaner apparatus using the cleaner head 30 of the present invention is described with reference to figure 1.

**[0034]** A mark 26 shows a blower. A suction opening 26A of the blower 26 and a vacuum space  $V_0$  are connected with a suction duct 27.

**[0035]** And, a discharge opening 26B of the blower 26 and a pressurized space  $P_0$  are connected with a discharge duct 28.

**[0036]** Further, a dust-removing filter 29 is disposed on the suction duct 27. With this construction, dust is removed with a circulation (of about 95 to 100%) of air.

**[0037]** The suction duct 27 is composed of branch ducts 27A and 27B respectively connected to the vacuum space  $V_0$  and a confluent duct 27Y to which the branch ducts 27A and 27B become confluent on a position shown by a point 31. And, the dust-removing filter 29 is disposed on the confluent duct 27Y.

**[0038]** Next, figure 6 shows another embodiment of the present invention. That is to say, a pressing and pulling force giving means 20, giving pressing force  $F_1$  and pulling force  $F_2$  to each of the pair of dividing inner wall portions 12 from outside of the surrounding outer wall portions 11 to slightly oscillate and deform the dividing inner wall portions 12 as to freely adjust the gap dimension  $\varepsilon$  of the discharging slit 6 on the forth ends of the dividing inner wall portions 12, is provided.

**[0039]** As the pressing and pulling force giving means

20, a bolt-nut connection to connect the vertical left face portion 11C and the dividing inner wall portion 12 (on the left side), and a bolt-nut connection to connect the vertical right face portion 11D and the dividing inner wall portion 12 (on the right side), are used in figure 6.

**[0040]** In figure 6, plural bolt-nut connections are disposed with a predetermined pitch in a direction at right angles with the surface of the figure. Not restricted to the construction shown in figure 6 in which the pressing force  $F_1$  and the pulling force  $F_2$  are selectively functioned, it is also preferable to dispose bolt-nut connections for only giving the pressing force and bolt-nut connections for only giving the pulling force in turn.

**[0041]** As described above, especially in a long cleaner head, adjustment can be rapidly and easily conducted for uniform air discharge along the whole length of the cleaner head because the pressing and pulling force giving means 20 to freely adjust the gap dimension  $\varepsilon$  of the discharging slit 6 is provided. Further, without disassembly of the cleaner head, the adjustment work of high accuracy can be conducted rapidly from outside even during the operation.

**[0042]** In the present invention, as shown in figure 4, suction flows  $F_7$  are generated on positions very near an area where a discharge flow  $F_6$  hits the dust-removed face 10, and the flows are very stable. Further, the flows don't generate vortex, and flow at high speed (with the shortest distance) from the exit of the discharging slit 6 to the opening end portion 7P of the sucking slit 7. By flowing as described above, the removed dust does not re-stick to the dust-removed face 10, and excellent dust-removing effect is shown.

**[0043]** And, the sucking slits 7 are inclined and the interval dimension  $W_{54}$  of the opening ends of the sucking slits 7 can be sufficiently small, and the discharge flow  $F_6$  comes close to the hitting area on the dust-removed face 10 further. Therefore, as shown in figure 5, the dust-removed body 9 such as a sheet body (film) can be dust-removed with a pair of the cleaner heads 30 on a middle position between feed rolls 21 and 22 without the backup roll 14 (as shown in figure 1). That is to say, there is also an advantage that air conveyance is possible without the backup roll 14 as shown in figure 5.

**[0044]** And, as shown in the cross sections in figure 3 and figure 4, a distance from a center point of the opening end portion 7P of the sucking slit 7 on one side and a center point of the opening end portion 7P of the sucking slit 7 on the other side is called interval dimension  $W_{54}$ .

**[0045]** As shown in figure 1, even in a case that the dust-removed body 9 is a sheet body (film) fed by the backup roll 14 in a direction of an arrow  $F_9$ , the gap (interval) with the lower face of the side 11A of the surrounding outer wall portion 11 is sufficiently small on the position of the downward opening portion of the sucking slit 7.

**[0046]** That is to say, comparing the dust-removed face 10 (II) and the dust-removed face 10 (III), on the position of the downward opening portion of the sucking slit 7, the gap (interval) with the lower face of the side 11A of the

surrounding outer wall portion 11 hardly generates difference, and sucking force through the sucking slit 7 is not different.

**[0047]** Therefore, when the dust-removed face 10 is any of (I), (II), and (III), the cleaner head 30 of the present invention can be applied (commonly used). On the contrary, in figures 8A, 8B, and 8C showing conventional examples, the corresponding face 56 must be concave low trapezoid or concave arc because the sucking slits 54 have to be prevented from being separated greatly from the dust-removed body 51.

**[0048]** In short, the cleaner head 30 of the present invention, in which the conventional corresponding face 56 of concave low trapezoid (refer to figure 8B) or concave arc (refer to figure 8C) is not necessary, can be commonly used with the same configuration (dust-removing function can be sufficiently shown).

**[0049]** An embodiment of the present invention is hereby described. Dimensions of the portions in figure 4 and pressures are preferably set as shown below.  $\Delta H$  is a gap dimension between the corresponding wall portion 15 and the dust-removed face 10.

**[0050]** That is to say:

$$11\text{mm} \leq W_{54} \leq 18\text{mm}$$

$$0.2\text{mm} \leq \varepsilon \leq 0.4\text{mm}$$

$$2\text{mm} \leq \alpha \leq 6\text{mm}$$

$$5\text{KPa} \leq P_p \leq 7\text{KPa}$$

$$-2.0\text{KPa} \leq V_p \leq -0.2\text{KPa}$$

$$1.5\text{mm} \leq \Delta H \leq 2.5\text{mm}$$

**[0051]** According to the embodiment of the present invention as shown above, high-pressure flow is jetted from an air reserve chamber pressurized to the pressure  $P_p$  of 5KPa to 7KPa through the discharging slit 6 of which gap dimension  $\varepsilon$  is 0.2mm to 0.4mm. The jetted flow hits the dust-removed face 10 distant for the gap dimension  $\Delta H=1.5\text{mm}$  to  $2.5\text{mm}$  to float foreign matter. The floated foreign matter is immediately sucked by the opening end portion 7P of the sucking slit 7. Therefore, there is an advantage that re-sticking of the foreign matter is not generated at all for high-speed and immediate sucking by the opening end portion 7P (without generation of vortex).

**[0052]** The dust-removing ability is determined by flowing speed. However, sucking ability determines whether the re-sticking is generated or not. The re-sticking of the

foreign matter can be sufficiently prevented because the above-mentioned  $V_p$  is appropriately low pressure, and the foreign matter is immediately sucked.

**[0053]** The present invention, as described above in detail, can correspond with flexibility to the dust-removed face 10 of the dust-removed body 9 of flat face (plane) and curved faces of large and small radiuses of curvature with the sufficiently small interval dimension  $W_{54}$  of the opening ends of the sucking slits 7 because in the cleaner head having the discharging slit 6 opening in the direction at right angles with the corresponding wall portion 15 having the flat outer face  $P_{15}$  facing the dust-removed face 10, and the pair of sucking slits 7 opening near upstream and downstream of the discharging slit 6, and, the outer extended lines  $L_7$  of the pair of sucking slits 7 are inclined as to mutually come close and intersect as departed from the flat outer face  $P_{15}$  of the corresponding wall portion 15, further, each of the sucking slits 7 has the inner faces 7S facing mutually parallel, and each of the inner faces 7S has a cross-sectional configuration of straight line, and reaches for the flat outer face  $P_{15}$  of the corresponding wall portion 15 keeping the configuration of straight line. Therefore, it is not necessary to prepare various cleaner heads.

**[0054]** Further, (as shown in figure 4) the opening width dimension of the opening end portion 7P becomes very small value for the construction in which the inner faces 7S of the sucking slit 7 reach for the flat outer face  $P_{15}$  of the corresponding wall portion 15 keeping the configuration of straight line to open the sucking slit 7.

**[0055]** Therefore, vortex is not generated in the sucked air on the opening end portion 7P, once removed dust in the air does not re-stick to the opening end portion 7P, and, "re-sticking" of the once removed dust is also not generated on the dust-removed face 10.

**[0056]** (As shown in figure 4,) the air jetted from the discharging slit 6 as the arrow  $F_6$  is immediately sucked by (the opening end portion 7P of) the sucking slit 7 extremely near to the discharging slit 6 as the arrow  $F_7$  (without generating vortex-like flow) to show an effect that "re-sticking" of the dust once removed from the dust-removed face 10 is not generated.

**[0057]** Especially, in the present invention, (as shown in figure 4,) perfect prevention effect of "re-sticking" is shown by dust removing from the dust-removed face 10 by flowing high-speed air through the parallel duct with the shortest distance (between the simple flat outer face  $P_{15}$  and the dust-removed face 10) formed between the opening portion of the discharging slit 6 and the opening end portion 7P of the sucking slit 7 mutually very close.

**[0058]** And, the cross-sectional configuration of the pair of dividing inner wall portions 12 does not form the narrow interval dimension  $W_a$  in the comparison example in figure 8, the problem of damage and early abrasion of the core of the extrusion die described with figure 8 can be solved, and, in spite of that, the interval dimension  $W_{54}$  of the opening ends of the sucking slits 7 can be made sufficiently small because the cleaner head of the

present invention is made of the extruded section 1, having the surrounding outer wall portion 11 and the pair of dividing inner wall portions 12 dividing the inner space of the surrounding outer wall portion 11 into the pressurized space  $P_0$  and vacuum spaces  $V_0$  as one unit, the surrounding outer wall portion 11, in cross-sectional configuration, has the side 11A of straight line disposed to face the dust-removed face 10, the dividing inner wall portions 12 are mutually approaching to form the predetermined angle  $2\theta$  of  $60^\circ$  to  $100^\circ$  and confluent with and connected to the side 11A, on the connected confluent position G, the discharging slit 6 to jet high-pressured air in the pressurized space  $P_0$  is opened, further, the pair of sucking slits 7 to suck the air after dust removing into the vacuum spaces  $V_0$  is formed parallel to each of the pair of dividing inner wall portions 12 mutually approaching with the predetermined angle  $2\theta$ , further, each of the sucking slits 7 has the inner faces 7S facing mutually parallel, and each of the inner faces 7S has a cross-sectional configuration of straight line, and reaches for the side 11A keeping the configuration of straight line.

**[0059]** As described above, the interval dimension  $W_{54}$  is sufficiently small, and the cleaner head can correspond with flexibility to the dust-removed face 10 of the dust-removed body 9 of (flat) plane and curved faces of large and small radiuses of curvature. Therefore, it is not necessary to prepare various cleaner heads.

**[0060]** Further, when  $2\theta < 60^\circ$ , the interval dimension  $W_{54}$  can't be sufficiently reduced, and sufficient dust removing is difficult depending on the configuration of the dust-removed face 10.

**[0061]** And, when  $2\theta > 100^\circ$ , the sucking area on the dust-removed face 10 is excessively small, and sufficient removal (sucking) of the dust is difficult.

**[0062]** Further, (as shown in figure 4) the opening width dimension of the opening end portion 7P becomes very small value for the construction in which the inner faces 7S of the sucking slit 7 reach for the side 11A keeping the configuration of straight line to open the sucking slit 7.

**[0063]** Therefore, vortex is not generated in the sucked air on the opening end portion 7P, once removed dust in the air does not re-stick to the opening end portion 7P, and, "re-sticking" of the once removed dust is also not generated on the dust-removed face 10.

**[0064]** (As shown in figure 4,) the air jetted from the discharging slit 6 as the arrow  $F_6$  is immediately sucked by (the opening end portion 7P of) the sucking slit 7 extremely near to the discharging slit 6 as the arrow  $F_7$  (without generating vortex-like flow) to show an effect that "re-sticking" of the dust once removed from the dust-removed face 10 is not generated.

**[0065]** Especially, in the present invention, (as shown in figure 4,) perfect prevention effect of "re-sticking" is shown by dust removing from the dust-removed face 10 by flowing high-speed air through the parallel duct with the shortest distance (between the side 11A and the dust-removed face 10) formed between the opening portion of the discharging slit 6 and the opening end portion 7P

of the sucking slit 7 mutually very close.

**[0066]** Especially in a long cleaner head, adjustment can be rapidly and easily conducted for uniform air discharge along the whole length of the cleaner head because the pressing and pulling force giving means 20, giving pressing force  $F_1$  and pulling force  $F_2$  to each of the pair of dividing inner wall portions 12 from outside of the surrounding outer wall portions 11 to slightly oscillate and deform the dividing inner wall portions 12 as to freely adjust a gap dimension  $\varepsilon$  of the discharging slit 6 on the forth ends of the dividing inner wall portions 12, is provided. Further, without disassemble of the cleaner head, the adjustment work of high accuracy can be conducted rapidly from outside even during the operation.

**[0067]** And, further-advanced dust-removing effect is shown because of the cleaner apparatus in which the blower 26 is provided, the suction opening 26A of the blower 26 and the vacuum space  $V_0$  are connected with the suction duct 27, the discharge opening 26B of the blower 26 and the pressurized space  $P_0$  are connected with the discharge duct 28, and, the dust-removing filter 29 is disposed on the suction duct 27 to remove dust with the circulation of air. That is to say, as clearly shown in figure 1, the discharging slit 6 and the sucking slits 7 are disposed to be proximate, when the dust is removed from the dust-removed face 10 by flowing high-speed air with the shortest distance, all of the amount of the air flow from the discharging slit 6 on the center is certainly sucked by the left and right sucking slits 7, outside air is not mixed, and sufficient dust removing can be rapidly and certainly conducted with efficiency.

## Claims

1. A cleaner head having a discharging slit (6) opening in a direction at right angles with a corresponding wall portion (15) having a flat outer face ( $P_{15}$ ) facing a dust-removed face (10), and a pair of sucking slits (7) opening near upstream and downstream of the discharging slit (6), comprising a construction in which:
  - outer extended lines ( $L_7$ ) of the pair of sucking slits (7) are inclined as to mutually come close and intersect as departed from the flat outer face ( $P_{15}$ ) of the corresponding wall portion (15), further, each of the sucking slits (7) has inner faces (7S) facing mutually parallel, and each of the inner faces (7S) has a cross-sectional configuration of straight line, and reaches for the flat outer face ( $P_{15}$ ) of the corresponding wall portion (15) keeping the configuration of straight line.
2. A cleaner head made of an extruded section (1), having a surrounding outer wall portion (11) and a pair of dividing inner wall portions (12) dividing an inner space of the surrounding outer wall portion (11) into a pressurized space ( $P_0$ ) and vacuum spaces ( $V_0$ ) as one unit, comprising a construction in which:

the surrounding outer wall portion (11), in cross-sectional configuration, has a side (11A) of straight line disposed to face a dust-removed face (10);

the dividing inner wall portions (12) are mutually approaching to form a predetermined angle ( $2\theta$ ) of  $60^\circ$  to  $100^\circ$  and confluent with and connected to the side (11A);

on a connected confluent position (G), a discharging slit (6) to jet high-pressured air in the pressurized space ( $P_0$ ) is opened, further, a pair of sucking slits (7) to suck the air after dust removing into the vacuum spaces ( $V_0$ ) is formed parallel to each of the pair of dividing inner wall portions (12) mutually approaching with the predetermined angle ( $2\theta$ ); and

further, each of the sucking slits (7) has inner faces (7S) facing mutually parallel, and each of the inner faces (7S) has a cross-sectional configuration of straight line, and reaches for the side (11A) keeping the configuration of straight line.

3. The cleaner head as set forth in claim 2, wherein a pressing and pulling force giving means (20), giving pressing force ( $F_1$ ) and pulling force ( $F_2$ ) to each of the pair of dividing inner wall portions (12) from outside of the surrounding outer wall portions (11) to slightly oscillate and deform the dividing inner wall portions (12) as to freely adjust a gap dimension ( $\varepsilon$ ) of the discharging slit (6) on the forth ends of the dividing inner wall portions (12), is provided.

4. A cleaner apparatus, to which the cleaner head of claim 2 is applied, having a construction in which:

a blower (26) is provided;

a suction opening (26A) of the blower (26) and a vacuum space ( $V_0$ ) are connected with a suction duct (27);

a discharge opening (26B) of the blower (26) and a pressurized space ( $P_0$ ) are connected with a discharge duct (28); and

a dust-removing filter (29) is disposed on the suction duct (27) to remove dust with a circulation of air.

## Amended claims in accordance with Rule 137(2) EPC.

1. A cleaner head made of an extruded section (1), having a surrounding outer wall portion (11) and a pair of dividing inner wall portions (12) dividing an inner space of the surrounding outer wall portion (11) into a pressurized space ( $P_0$ ) and vacuum spaces ( $V_0$ ) as one unit, comprising a construction in which:

the surrounding outer wall portion (11), in cross-sectional configuration, has a side (11A) of straight line disposed to face a dust-removed face (10);

the dividing inner wall portions (12) are mutually approaching to form a predetermined angle ( $2\theta$ ) of  $60^\circ$  to  $100^\circ$  and confluent with and connected to the side (11A);

on a connected confluent position (6), a discharging slit (6) to jet high-pressured air in the pressurized space ( $P_0$ ) is opened, further, a pair of sucking slits (7) to suck the air after dust removing into the vacuum spaces ( $V_0$ ) is formed parallel to each of the pair of dividing inner wall portions (12) mutually approaching with the predetermined angle ( $2\theta$ ); and

further, each of the sucking slits (7) has inner faces (7S) facing mutually parallel, and each of the inner faces (7S) has a cross-sectional configuration of straight line, and reaches for the side (11A) keeping the configuration of straight line;

**characterized in that**

a pressing and pulling force giving means (20), giving pressing force ( $F_1$ ) and pulling force ( $F_2$ ) to each of the pair of dividing inner wall portions (12) from outside of the surrounding outer wall portions (11) to slightly oscillate and deform the dividing inner wall portions (12) as to freely adjust a gap dimension ( $\varepsilon$ ) of the discharging slit (6) on the forth ends of the dividing inner wall portions (12), is provided.

2. A cleaner apparatus, to which the cleaner head of claim 1 is applied, having a construction in which:

a blower (26) is provided;

a suction opening (26A) of the blower (26) and a vacuum space ( $V_0$ ) are connected with a suction duct (27);

a discharge opening (26B) of the blower (26) and a pressurized space ( $P_0$ ) are connected with a discharge duct (28); and

a dust-removing filter (29) is disposed on the suction duct (27) to remove dust with a circulation of air.

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FIG. 1

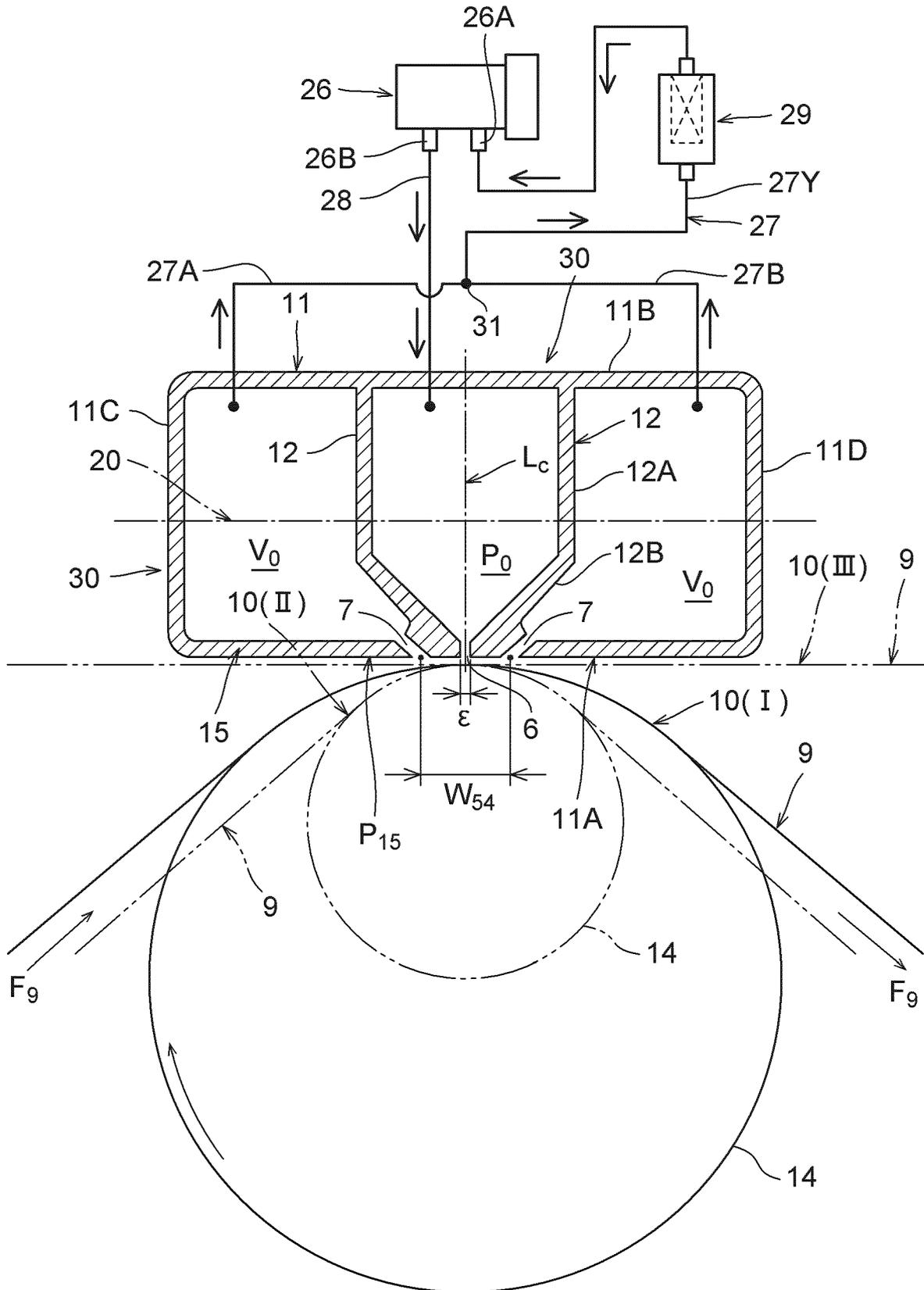


FIG. 2

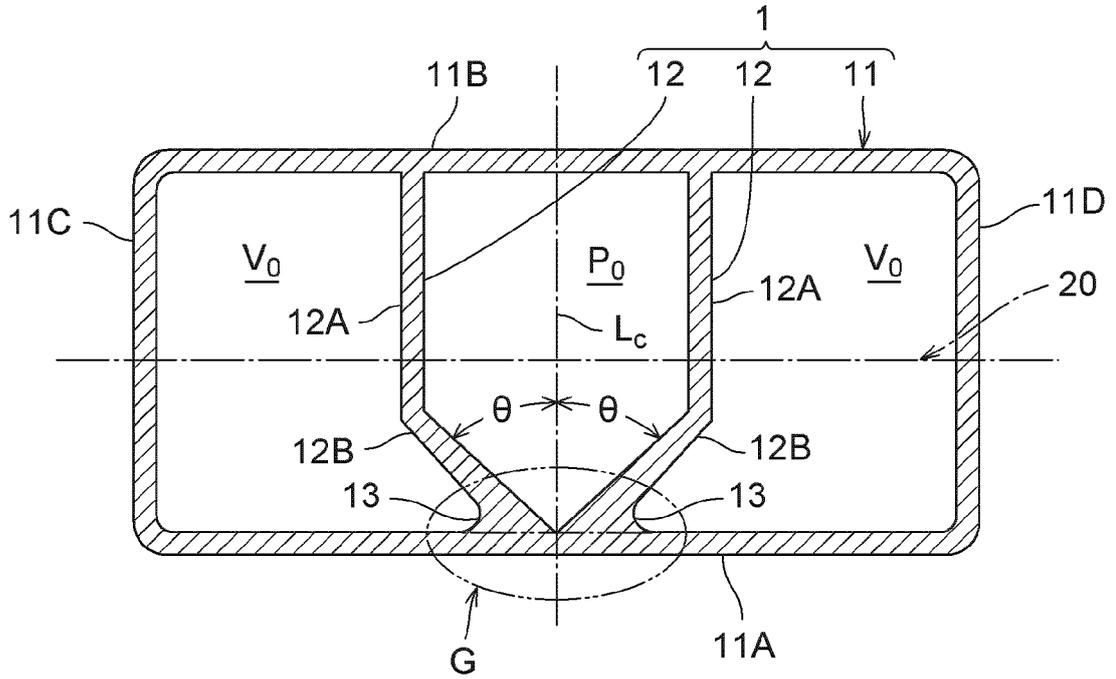


FIG. 3

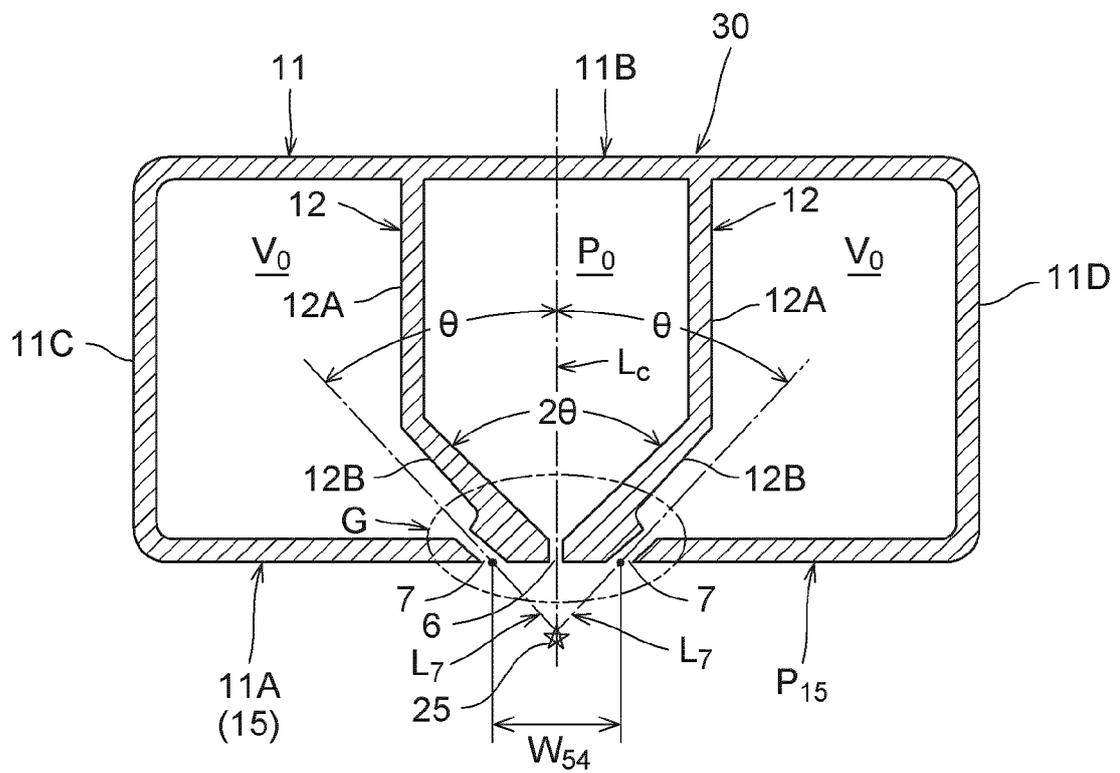


FIG.4

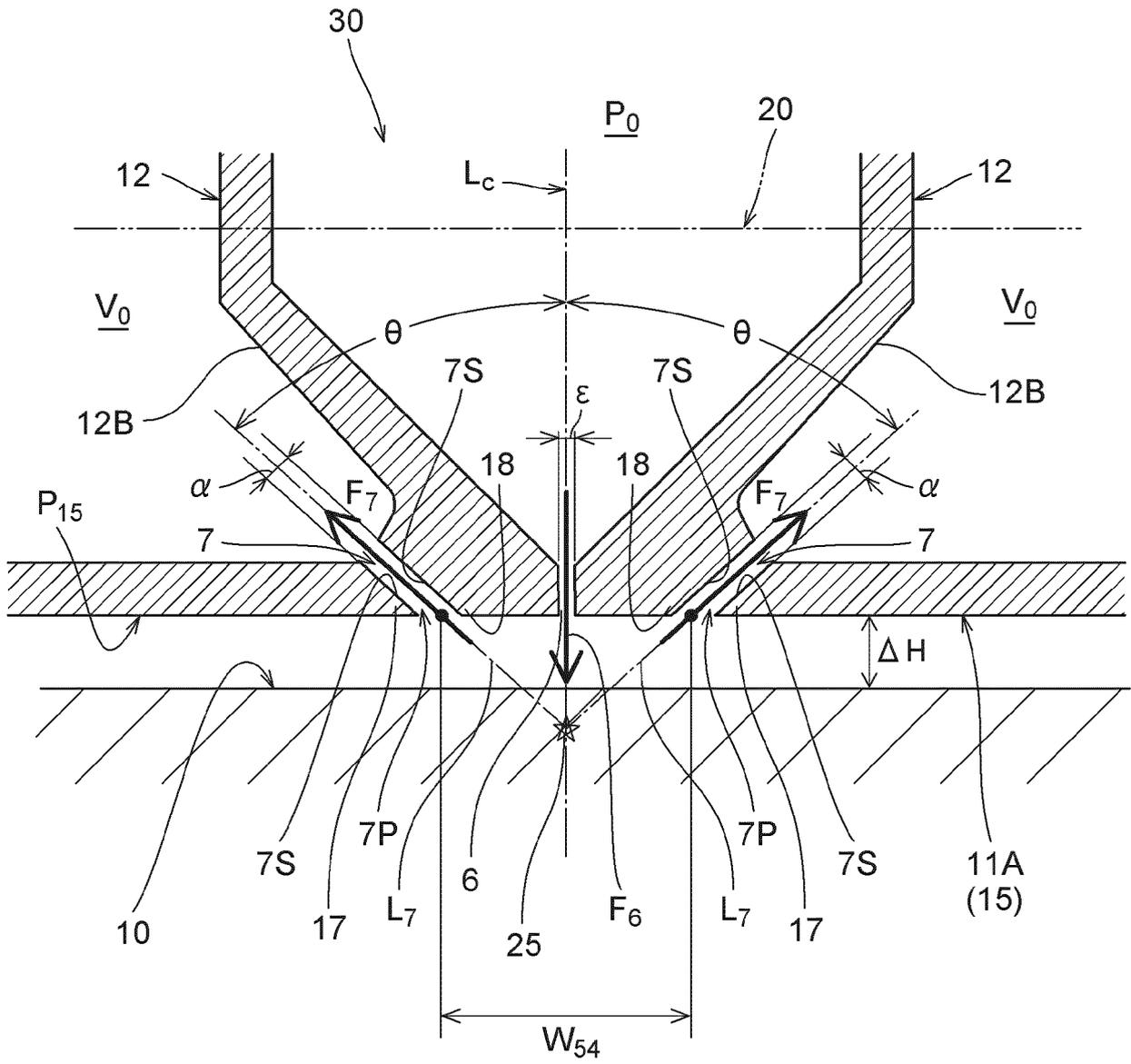


FIG.5

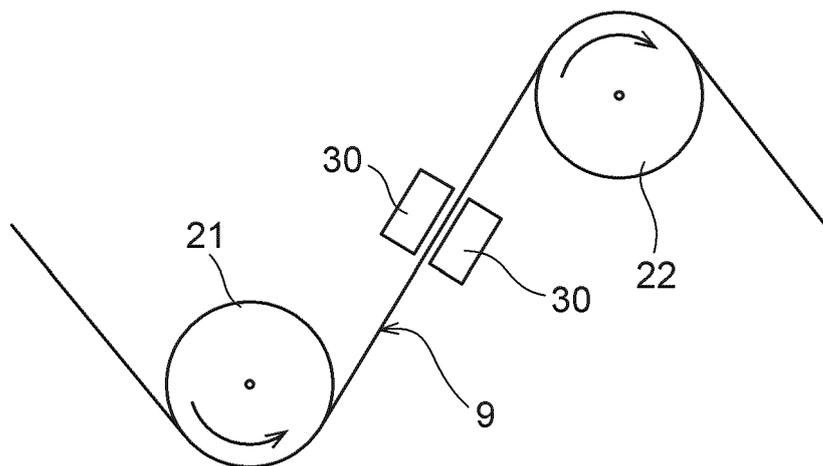


FIG.6

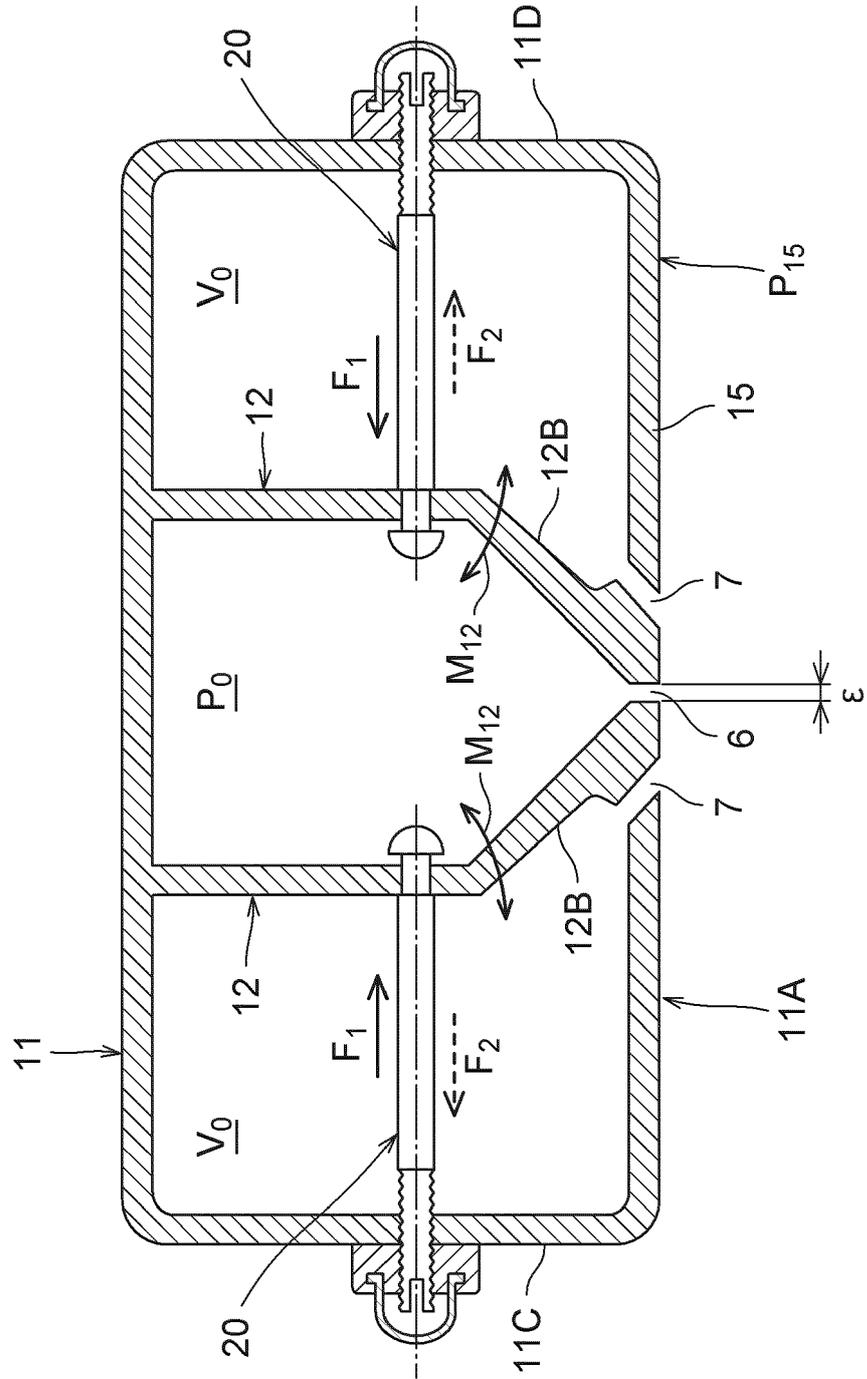


FIG.7  
PRIOR ART

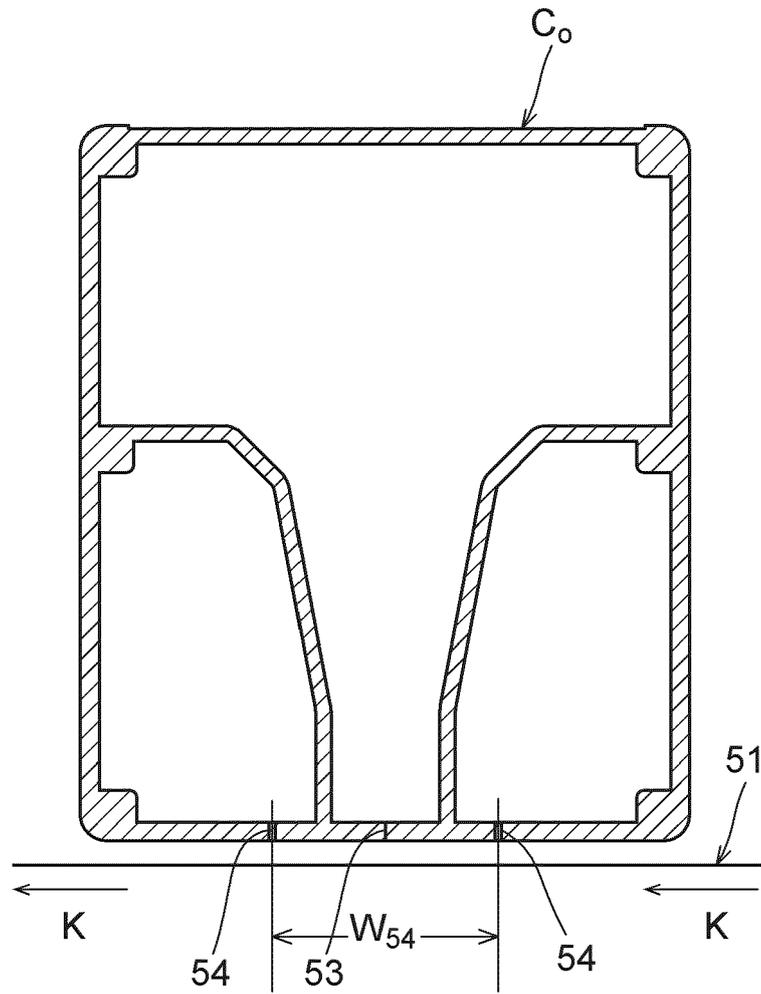


FIG.8A  
PRIOR ART

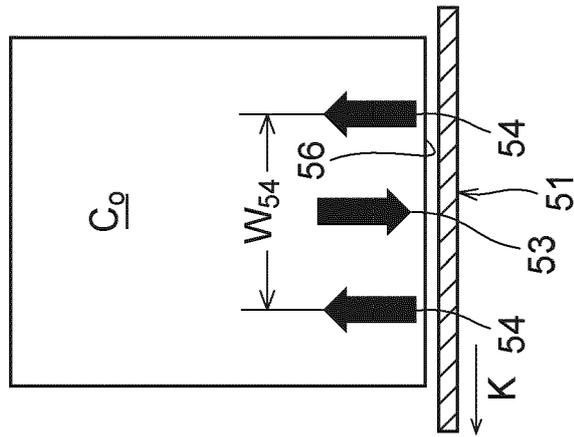


FIG.8B  
PRIOR ART

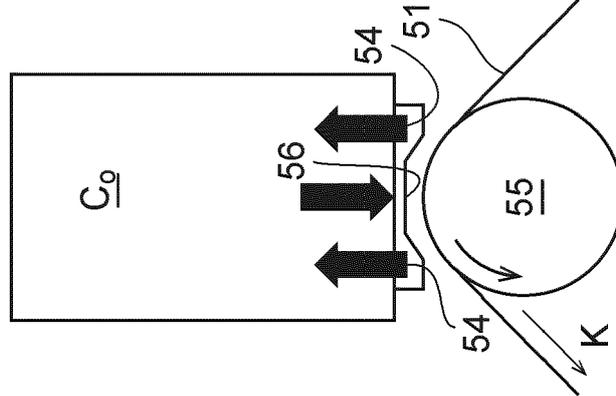


FIG.8C  
PRIOR ART

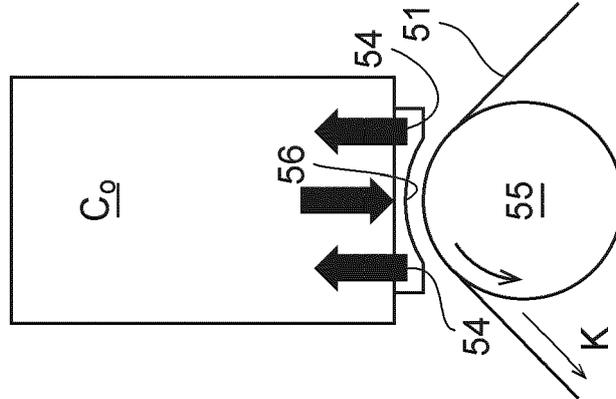
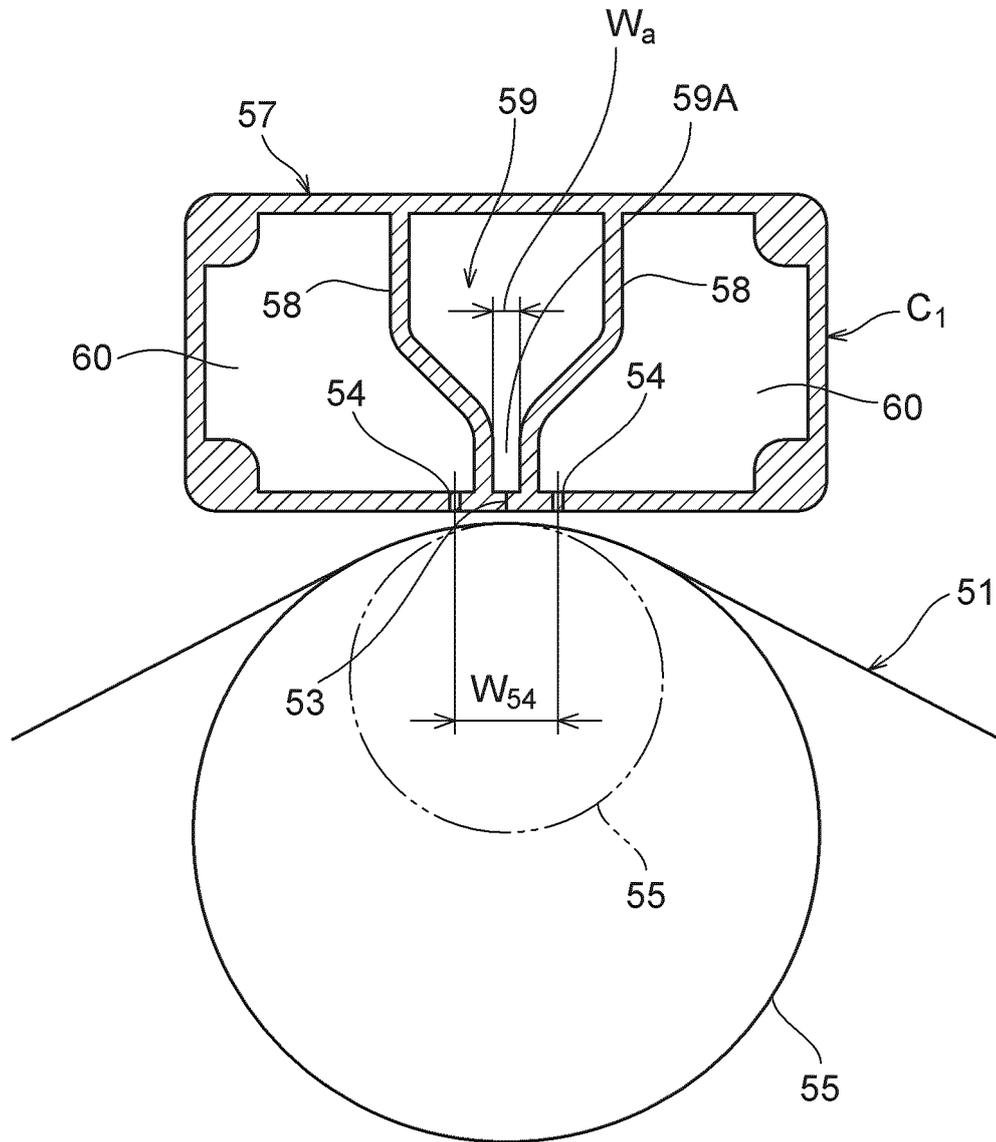


FIG.9





EUROPEAN SEARCH REPORT

Application Number  
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DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
X	JP 6 110111 B2 (NITTO KOGYO KK) 5 April 2017 (2017-04-05)	1, 2, 4	INV. A47L9/08	
A	* paragraphs [0018] - [0027] * -----	3		
X	JP 2008 055398 A (MIYATA KUNIO) 13 March 2008 (2008-03-13)	1		
A	* paragraph [0027]; figures * -----	2-4		
A	US 2002/184730 A1 (ALLEN DONAVAN J [US] ET AL) 12 December 2002 (2002-12-12) * figure 3 *	1-4		
A	GB 732 972 A (ASBRINK & COMPANY AB) 6 July 1955 (1955-07-06) * figure 1 * -----	1-4		
The present search report has been drawn up for all claims				TECHNICAL FIELDS SEARCHED (IPC)
				A47L
Place of search		Date of completion of the search		Examiner
Munich		5 September 2022		Eckenschwiller, A
CATEGORY OF CITED DOCUMENTS				
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document		

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EPO FORM 1503 03:82 (F04C01)



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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

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Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

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No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

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**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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**see sheet B**

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All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

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As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

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Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

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None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number  
**EP 22 15 4479**

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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**1. claim: 1**

**Providing a cleaner head having a combination of blowing and suction means**

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**2. claims: 2-4**

**Providing a suction head with a vacuum space and a pressurized space**

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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 22 15 4479

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-09-2022

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**REFERENCES CITED IN THE DESCRIPTION**

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