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(71) Applicant: **ARIA-C S.R.L.**
37069 Vilafrance di Verona (VR) (IT)

(72) Inventors:
• **Caliari, Francesco**
37066, Sommacampagna (VR) (IT)
• **Pasetto, Marco**
37059, Zevio (VR) (IT)
• **Varaschini, Michele**
37069, Villafranca di Verona (VR) (IT)

(74) Representative: **Crugnola, Pietro**
Luppi & Associati S.r.l.
Via Camperio, 11
20123 Milano (IT)

(54) **Drying apparatus**

(57) A drying apparatus for drying painted objects comprises an operating area (2) arranged for receiving a painted object to be dried, main air flow generator means (5) arranged for taking air from an environment arranged outside said operating area (2) and generating a main air flow (F1) between an inlet (6) facing said operating area (2) and an outlet (7) facing said operating area (2), auxiliary air flow generator means (20) arranged for generating inside said operating area (2) an auxiliary

air flow (F2) substantially transverse to said main air flow (F1), said auxiliary air flow generator means (20) comprising delivering means (21) arranged inside said operating area (2) to release said air in said operating area (2), said auxiliary air flow generator means (20) comprising heating means (27) arranged outside said operating area (2).

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Description

[0001] The invention relates to a drying apparatus for drying painted objects, specifically, car bodies.

[0002] Painting apparatuses are known comprising a painting booth provided with an air flow generator which supplies air into the painting booth and extracts the air present in the painting booth. The air flow generator is activated during the painting to remove from the painting booth the paint particles which do not adhere to the object to be painted and paint solvent substances which, if not removed, would remain suspended in the air inside the painting booth. The air flow generator is also activated after the painting to allow drying of the painted object.

[0003] The air flow generator generates a main air flow inside the painting booth between a first inlet provided in the painting booth, and an outlet provided in the painting booth.

[0004] The painting booth is provided with a further air flow generator which generates an auxiliary air flow which is transverse to the main air flow.

[0005] The main air flow is obtained by means of a first fan which sucks air from an environment arranged outside the painting booth and pushes it through a main duct connected to the first inlet. A heater may be inserted in the main duct. A second fan sucks air from the painting booth through an outlet duct connected to the outlet.

[0006] A plenum can be provided between the main duct and the first inlet to receive the heated air from the main duct and diffuse it through the first inlet.

[0007] The auxiliary flow of air is obtained by means of an intake duct which takes air from the main duct and conveys the taken air into a column-shaped casing arranged inside the painting booth. The air of the main duct may be heated if the heater is present. The column-shaped casing is provided with a plurality of holes or nozzles which let air into the painting booth transversely to the main air flow.

[0008] The intake duct can take air, possibly heated, directly from the plenum, if present, instead of from the main duct.

[0009] In any case, a third fan is connected to the intake duct which makes it possible to suck air from the environment arranged outside the painting booth, or from the main duct, or from the plenum, and send the sucked air through the intake duct.

[0010] The use of water-based paints is becoming widespread in the painting sector and, in comparison to traditional paints containing organic solvent these make it possible to reduce emissions of polluting agents.

[0011] As is well known, a large quantity of air or a higher air temperature compared to organic solvent paints, or a combination of these conditions, is required to dry water-based paints.

[0012] The known types of air flow generators do not allow rapid drying of a painted object inside the painting booth.

[0013] In fact, as the auxiliary air flow is obtained with

air taken from the main air flow, its temperature is equal to or less than that of the air of the main air flow. This temperature is not sufficient for removing the water present in the water-based paint so rapidly as in case of drying organic-solvent paint.

[0014] Moreover, the auxiliary air flow cools the main air flow, causing a non uniform temperature inside the painting booth during the drying of the painted object.

[0015] An object of the invention is to improve the apparatuses for drying painted objects of known type.

[0016] Another object is to obtain a drying apparatus for drying painted objects that is efficient and economical.

[0017] Still another object is to produce a drying apparatus that allows effective and rapid drying of painted objects at relatively limited costs.

[0018] According to the invention, a drying apparatus is provided for drying painted objects comprising an operating area arranged for housing a painted object to be dried, main air flow generator means arranged for taking air from an environment arranged outside said operating area and generating a main air flow between an inlet facing said operating area and an outlet facing said operating area, auxiliary air flow generator means arranged for generating inside said operating area an auxiliary air flow substantially transverse to said main air flow, said auxiliary air flow generator means comprising delivering means arranged inside said operating area to release said air in said operating area, characterized in that said auxiliary air flow generator means comprises heating means arranged outside said operating area.

[0019] Owing to the heating means, it is possible to heat the air of the auxiliary air flow until it reaches a required temperature.

[0020] Furthermore, the heating means can determine the temperature of the auxiliary air flow independently of the temperature of the main air flow.

[0021] This makes it possible to considerably reduce the time required for drying the painted object.

[0022] Furthermore, as the heating means is outside the operating area, it is possible to adjust its working without entering the operating area.

[0023] This makes it possible, in particular during maintenance operations on the heating means, to reach the heating means without necessarily stopping the drying apparatus.

[0024] In an embodiment, said heating means is arranged in a region above said operating area.

[0025] The invention will be better understood and carried into effect with reference to the attached drawings, in which some embodiments are shown by way of non-limiting example, in which:

Figure 1 is a right-hand perspective view of a drying apparatus for drying a painted object;

Figure 2 is a left-hand perspective view of the drying apparatus of Figure 1;

Figure 3 is a longitudinal section of the drying apparatus of Figure 1;

Figure 4 is a schematic view of a drying apparatus for drying a painted object according to an alternative embodiment;

Figure 5 is a schematic view of a drying apparatus for drying a painted object according to a further alternative embodiment.

[0026] With reference to Figures 1 and 2, a drying apparatus 1 for drying painted objects, for example, car bodies, comprises an operating area, in particular a drying area 2, arranged for housing a painted object to be dried.

[0027] The drying area 2 may be provided inside a painting booth 3 in which painting of the object initially takes place. The painting booth 3 comprises a box-shaped body 4, provided with lateral walls and an upper wall.

[0028] In an alternative embodiment not shown, in place of the body 4 provided with lateral walls, there is provided that the drying area 2 may be laterally surrounded by flexible elements, such as made of rubber, in such a way as to form one or more curtains.

[0029] The drying apparatus 1 comprises first air flow generator means 5 arranged for taking air from an environment arranged outside the drying area 2 and generating a first air flow between an inlet 6 facing the drying area 2 and an outlet 7 facing the drying area 2 and the opposite inlet 6. In embodiments not shown, the outlet 7 is not opposite the inlet 6. For example, the outlet 7 may be arranged along a lateral wall of the body 4.

[0030] The inlet 6 is arranged above the drying area 2 and the outlet 7 is defined by openings 8 made in the base 9 of the body 4. The openings 8 are spaced apart from one another by longitudinal elements 10.

[0031] In an embodiment not shown, the outlet 7 comprises grille elements. For example, the outlet 7 can be made in a floor provided with grilles in painting booth 3.

[0032] The first air flow generator means 5 comprises a suction duct 11, drawn with a broken line in Figure 1, communicating with the environment arranged outside the drying area 2. The suction duct 11 is connected to a primary fan 13 which takes air through the suction duct 11 and sends it towards the drying area 2.

[0033] Between the suction duct 11 and the primary fan 13, a recirculation shutter 16 is provided, the working of which will be explained subsequently.

[0034] In an embodiment not shown, the recirculation shutter 16 may also not be present.

[0035] The air sucked by the primary fan 13, before reaching the drying area 2, passes through a heater 12 which heats the sucked air to the required temperature necessary for drying the painted object, and a primary connector 14. The primary connector 14 is interposed between the heater 12 and a plenum 15 arranged above the drying area 2. The plenum 15 distributes the heated air coming from the primary connector 14 through the inlet 6 of the drying area 2 in such a manner that a first air flow F1 (Figure 3) is directed from inlet 6 to outlet 7

into the drying area 2.

[0036] The first air flow generator means 5 further comprises an extraction fan 17 which takes air from the drying area 2 through an extraction duct 18 connected to outlet 7. An outlet duct 19, shown by a broken line in Figure 1, is connected to extraction fan 17, and through it the air extracted from the drying area 2 is released into the environment arranged outside the drying area 2.

[0037] The drying apparatus 1 further comprises second air flow generator means 20 arranged for generating inside the drying area 2 a second air flow F2 substantially transverse to the first air flow F1.

[0038] The air flow rate of the first air flow F1 is greater than the air flow rate of the second air flow F2.

[0039] The first air flow F1 can therefore be defined as the main air flow and the second air flow F2 as the secondary or auxiliary air flow.

[0040] The second air flow generator means 20 comprises a secondary fan 25 which sucks air from the environment arranged outside the drying area 2. The secondary fan 25 is arranged above the drying area 2, in particular, it is mounted above the plenum 15. A suction port 26 of the secondary fan 25 can be connected to a secondary suction duct not shown.

[0041] The secondary fan 25 pushes the air through a further heater 27, outside the drying area 2, to heat the air of the second air flow F2.

[0042] In an alternative embodiment, not shown, the second air flow generator means 20, in particular the secondary fan 25 and the further heater 27, is not arranged above the heating area 2, but on an outer side of the drying area 2, for example, a side adjacent to or a side opposite to that in which the first air flow generator means 5 is mounted.

[0043] Two secondary connectors 28, opposite to each other, lead off the further heater 27, such two secondary connectors 28 conveying the heated air from the further heater 27 in respective distribution ducts 29. In place of the two secondary connectors 28 a single "T" shaped connector may be provided.

[0044] Each distribution duct 29 comprises a first branch 30 which lead off the respective connector 28 and extends substantially parallel to a wall 31, which delimits the drying area 2 on top, and a second branch 32 substantially perpendicular to the first branch 30 and connected to it by means of a curved connector 33.

[0045] The second branch 32 conveys the air into delivering means 21 arranged inside the drying area 2.

[0046] The delivering means 21 comprises a plurality of diffuser elements 22, in particular four diffuser elements 22, arranged at the inner corners of the painting booth 3.

[0047] Each diffuser element 22 comprises an elongated member 23 which extends along a longitudinal axis L substantially parallel to a lateral wall of the painting booth 3. The elongated member 23 is provided with a longitudinal opening, not shown, for example, a slit which extends parallel to longitudinal axis L. The slit is provided

with a deviator element, which makes it possible to divert the air coming out of the slit so as to direct this air effectively against the painted object to be dried. The diverter element comprises for example an adjustable fin extending substantially along the entire length of the slit. The fin is for example rotatable around an axis parallel to longitudinal axis L. The fin may be rotated manually and oriented in such a manner that it assumes a required position, in particular, before drying.

[0048] In addition to or as alternative, the fin may be rotated automatically by driving means. In particular, if the fin is adjustable automatically, it is possible to modify its orientation also during the drying. The fin may for example be moved alternately between the two predefined angular positions.

[0049] The fin may be so shaped as to close the slit if arranged in a defined angular position.

[0050] In an embodiment, a plurality of slits are provided, substantially parallel, each slit being provided with a respective diverter element arranged for directing the air coming out of the slit. Each diverter element may be positioned manually, or automatically by driving means, before drying as well as during the drying, so as to direct the air which forms the second air flow F2 as required, to effectively reach the surface of the painted object. In particular, each diverter element may be also driven to rotate between defined angular positions during the drying.

[0051] The delivering means can be shaped differently from the delivering means shown in the Figures or from the delivering means described above.

[0052] The delivering means 21, instead of being arranged at the corners of the painting booth 3, can be arranged along the length of the lateral walls of the painting booth 3.

[0053] Owing to the further heater 27, it is possible to heat the air of the second air flow F2.

[0054] The further heater 27, therefore, makes it possible to considerably reduce the drying time of the painted object.

[0055] Moreover, as the further heater 27 is separate from the heater 12, it is possible to heat the air of the second air flow F2 independently of the air of the first air flow F1.

[0056] The second air flow F2 can reach a required temperature, for example, equal to the temperature of the first air flow F1.

[0057] The drying apparatus 1 is particularly suitable for drying objects painted with water-based paints.

[0058] In fact, the second air flow F2 is heated by the further heater 27, thus reducing the evaporation time of the watery solvent.

[0059] Moreover, the second air flow F2, when meets the first air flow F1, causes turbulences around the surface of the painted object, such turbulences facilitating the elimination of the water of the water-based paint.

[0060] The air of the second air flow F2 can be rather fast, thus favouring transfer of the watery solvent from

the liquid state to the gaseous state.

[0061] In particular, the air of the second air flow F2 is faster than the air of the first air flow F1.

[0062] Since the further heater 27 is arranged outside the drying area 2, an operator can easily reach the further heater 27 also when the drying apparatus 1 is operating, without the operator having to enter the drying area 2.

[0063] As is known, an operator, who enters the drying area 2 during the drying, i.e. when the first air flow generator means 5 and the second air flow generator means 20 are working, can introduce polluting agents into the painting booth 3 which can damage the paint applied to the object. In fact, the air of the first air flow F1 and the second air flow F2 can transport such polluting agents, which could be launched against the painted surface of the object thus getting entrapped in the paint. The painted surface would therefore become irreparably damaged.

[0064] The fact that the further heater 27 is arranged outside the drying area 2 therefore limits the risks of pollution of the painted object.

[0065] The further heater 1 may be also activated during the so-called "flash-off cycle", i.e. to dry a layer of paint before applying a further layer of paint on it.

[0066] In this case, the further heater 1 makes it possible to considerably reduce the time required for completing the flash-off cycle.

[0067] In use, an object arranged in the drying area 2 is first painted. During the painting, the first air flow generator means 5 is activated to extract from the painting booth 3 the paint particles that do not adhere to the object to be painted and the paint solvent substances which, if not removed, would remain suspended in the air inside the painting booth 3.

[0068] After the painting, the painted object needs to be dried. The first air flow generator means 5 and the second air flow generator means 20 are, therefore, activated after the painting to allow drying of the painted object.

[0069] As shown in Figure 3, the recirculation shutter 16 is positioned between the suction duct 11 and the extraction duct 18 and between the primary fan 13 and the extraction fan 17. The recirculation shutter 16 is movable between a first operating position A, in which the recirculation shutter 16 separates the suction duct 11 from the outlet duct 19, and a second operating position B, in which the recirculation shutter 16 partly closes the suction duct 11, partly closes the outlet duct 19 and connects the extraction duct 18 with the primary fan 13.

[0070] During the painting, the recirculation shutter 16 is arranged in the first operating position A.

[0071] During the drying, the recirculation shutter 16 is arranged in the second operating position B. In this condition, the air present in the drying area 2 is extracted through the extraction duct 18 and a part of the air extracted is forced by the primary fan 13 to return to the drying area 2 after passing through the heater 12. In this case, a part of the air flows through a closed path facilitating rapid drying of the paint.

[0072] In the embodiment of Figure 3, the heater 12 comprises a duct gas burner 34.

[0073] Alternatively, the heater 12 may comprise a burner provided with a combustion chamber, or a heat exchanger.

[0074] If the temperature of the air outside the drying area 2 is sufficiently high, the heater 12 may not even be activated.

[0075] In an embodiment not shown, the heater 12 may not be present.

[0076] In the last two cases, the temperature of the air of the first air flow F1 let into the drying area 2 is substantially equal to that of the air taken by the primary fan 13 from outside the drying area 2. The temperature of the second air flow F2 can, however, be adjusted as required using the further heater 27.

[0077] In any one of the embodiments described above, also the further heater 27 may remain inactive during the painting and/or during the drying.

[0078] The further heater 27 may comprise a burner provided with a combustion chamber, or a heat exchanger, or a duct gas burner, for example, similar to duct gas burner 34.

[0079] The first air flow generator means 5 and the second air flow generator means 20 comprise a plurality of filters, not shown, for filtering the air to purify it from particles and impurities.

[0080] The drying apparatus 1 further comprises a control unit, not shown, arranged for driving the fans and/or heaters included in the apparatus.

[0081] Instead of the fans described above, pumps may be provided.

[0082] Figures 4 and 5 show alternative embodiments of the drying apparatus, in which the parts common to the embodiments previously described are indicated with the same reference numbers.

[0083] Figure 4 shows a drying apparatus 100 in which there is no plenum and the air coming from the heater 12 is introduced directly into the heating area 2 through the primary duct 35 connected to inlet 6. The first air flow F1 proceeds from inlet 6 to outlet 7.

[0084] A secondary duct 36, connected to the secondary fan 25, takes air from the primary duct 35 and sends it to the drying area 2 through the further heater 27 and through the distribution duct 29. From the distribution duct 29 the air reaches the delivering means, not shown, which produces the second air flow F2 inside the drying area 2.

[0085] Figure 5 shows a drying apparatus 200, in which, as compared to the embodiment in Figure 4 the plenum 15 is provided. The primary duct 35 connects the heater 12 to the plenum 15. In this embodiment, the secondary duct 236 takes air not from the primary duct 35, but from the plenum 15.

[0086] In an embodiment not shown and similar to that shown in Figure 4, there is provided that the primary duct 35 is connected to a plenum to convey air into the plenum and the secondary duct 36 is connected to the primary

duct 35 to take a fraction of air from the primary duct 35.

[0087] The secondary duct 36 can, therefore, be connected to the primary duct 35 to take air from the latter and send it to the drying area 2 to form the second air flow F2, whether the primary duct 36 is connected directly to inlet 6, or whether a plenum is provided between the primary duct 35 and inlet 6.

[0088] In an alternative embodiment shown in Figure 5, a further secondary duct 336 is provided, indicated by a broken line in Figure 5, connecting the primary duct 35 directly to the secondary fan 25. In this embodiment, the second air flow F2 can be generated by air coming from the plenum 15 through the secondary duct 236 and/or by air coming from the heater 12 through the further secondary duct 336.

[0089] In a further embodiment not shown, the second air flow F2 can be obtained from air taken directly from the drying area 2, for example, through an outlet opening made in painting booth 3. The air taken from the drying area 2, for example by means of an intake duct, is sent back into the drying area 2 by means of the delivering means, after passing through the further heater.

[0090] The intake duct which takes air directly from the drying area 2 may be provided as an alternative or in addition to the secondary duct 36, 236, 336 provided in the embodiments described above.

[0091] In a further embodiment not shown, the auxiliary air flow generator means 20 is connected to the outlet duct 19 of the main air flow generator means 5, this outlet duct 19 being arranged for conducting the air from the painting area 2 towards the outside environment. In this embodiment, the second air flow F2 is obtained from the air taken by the outlet duct 19.

Claims

1. Drying apparatus for drying painted objects comprising an operating area (2) arranged for receiving a painted object to be dried, main air flow generator means (5) arranged for taking air from an environment arranged outside said operating area (2) and generating a main air flow (F1) between an inlet (6) facing said operating area (2) and an outlet (7) facing said operating area (2), auxiliary air flow generator means (20) arranged for generating inside said operating area (2) an auxiliary air flow (F2) substantially transverse to said main air flow (F1), said auxiliary air flow generator means (20) comprising delivering means (21) arranged inside said operating area (2) to release said air in said operating area (2), **characterized in that** said auxiliary air flow generator means (20) comprises heating means (27) arranged outside said operating area (2).
2. Drying apparatus according to claim 1, wherein said auxiliary air flow generator means (20) takes air directly from said outside environment to generate said

auxiliary air flow (F2).

3. Drying apparatus according to claim 1 or 2, wherein said auxiliary air flow generator means (20) takes air directly from said operating area (2) to generate said auxiliary air flow (F2). 5
4. Drying apparatus according to any one of claims 1 to 3, wherein said auxiliary air flow generator means (20) is connected to said main air flow generator means (5) to take air from said main air flow generator means (5) and generate said auxiliary air flow (F2). 10
5. Drying apparatus according to claim 4, wherein said auxiliary air flow generator means (20) is connected to an outlet duct (19) of said main air flow generator means (5) to take air from said outlet duct (19), said outlet duct (19) being arranged for conveying said air from said operating area (2) towards said outside environment. 15 20
6. Drying apparatus according to any one of claims 1 to 5, wherein said auxiliary air flow generator means (20) comprises fan means (25) connected to said heating means (27). 25
7. Drying apparatus according to any one of claims 1 to 6, wherein said auxiliary air flow generator means (20) further comprises intake duct means (26; 36; 236; 336), said intake duct means (26; 36; 236; 336) comprising a duct (36; 336) connected to primary duct means (14; 35), provided in said main air flow generator means (5) and suitable for transferring said air coming from said outside environment towards said inlet (6). 30 35
8. Drying apparatus according to claim 7, wherein said main air flow generator means (5) further comprises a plenum (15) for distributing air through said inlet (6), said plenum (15) being interposed between said primary duct means (14; 35) and said operating area (2). 40
9. Drying apparatus according to claim 8, wherein said intake duct means (26; 36; 236; 336) comprises a further duct (236) connected to said plenum (15) for taking air from said plenum (15). 45
10. Drying apparatus according to claim 8 or 9, wherein said intake duct means (26; 36; 236; 336) comprises a still further duct connected directly to said operating area (2) for taking air from said operating area (2). 50
11. Drying apparatus according to any preceding claim, wherein said auxiliary air flow generator means (20) further comprises piping means (28, 29) connecting said heating means (27) to said delivering means (21), said piping means (28, 29) comprising a portion (28, 30, 33) external to said operating area (2). 55
12. Drying apparatus according to claim 11, wherein said piping means (28, 29) further comprises a portion (32) internal to said operating area (2).
13. Drying apparatus according to any preceding claim, wherein said delivering means (21) comprises a diffuser element (22) arranged inside said operating area (2).
14. Drying apparatus according to claim 13, wherein said diffuser element (22) comprises deviator means for deviating said air delivered by said delivering means (21).
15. Drying apparatus according to claim 14, wherein said deviator means is movable so as to direct said air according to a required direction.
16. Drying apparatus according to claim 14, or 15, wherein said deviator means is movable between a closure position wherein said deviator means closes opening means provided in said diffuser element (22) and a plurality of opening positions in which said deviator means opens said opening means.
17. Drying apparatus according to any one of claims 14 to 16, and further comprising driving means suitable for driving said deviator means automatically.
18. Drying apparatus according to any preceding claim, wherein said operating area (2) is provided inside a painting booth (3).

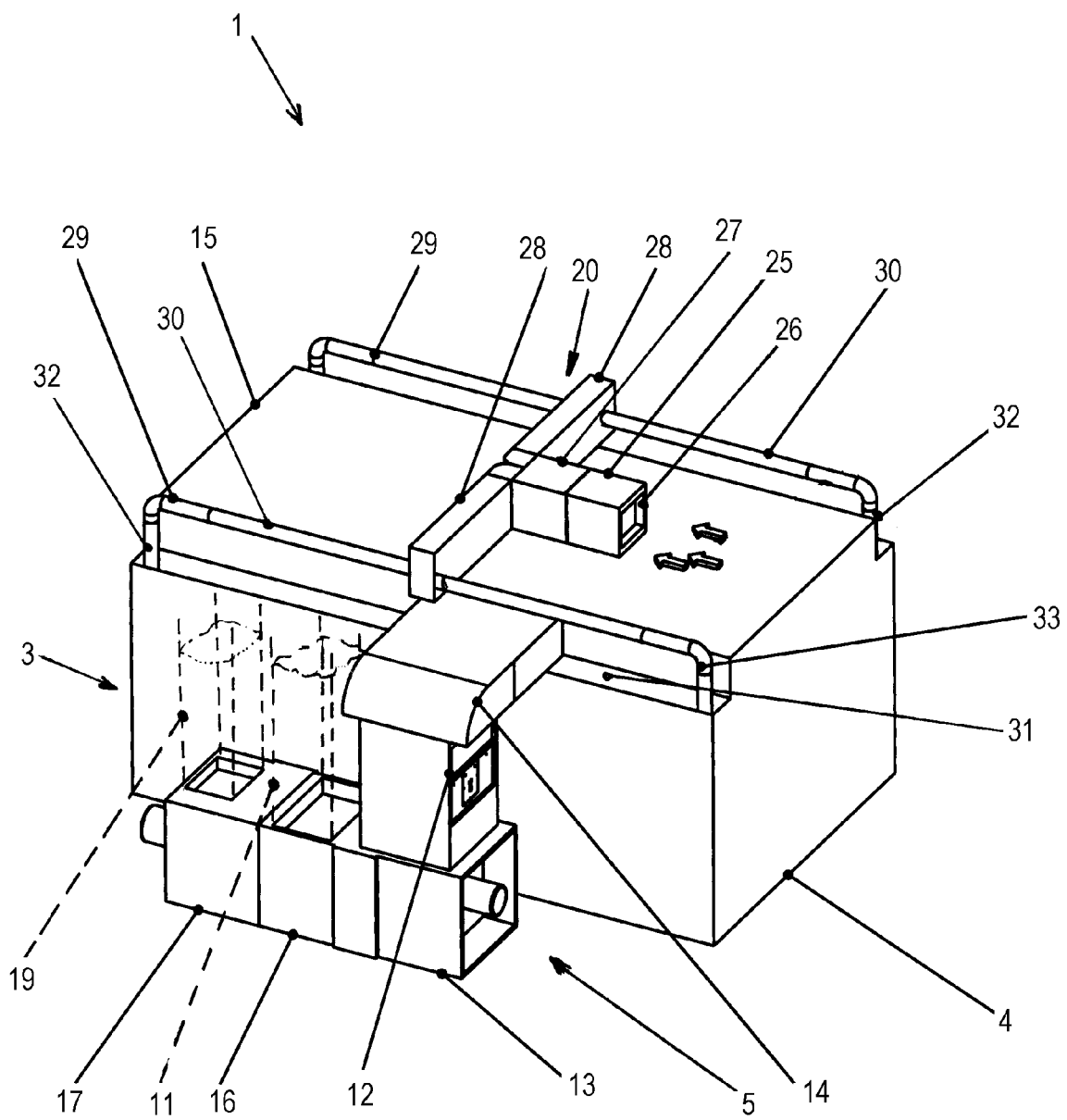


Fig. 1

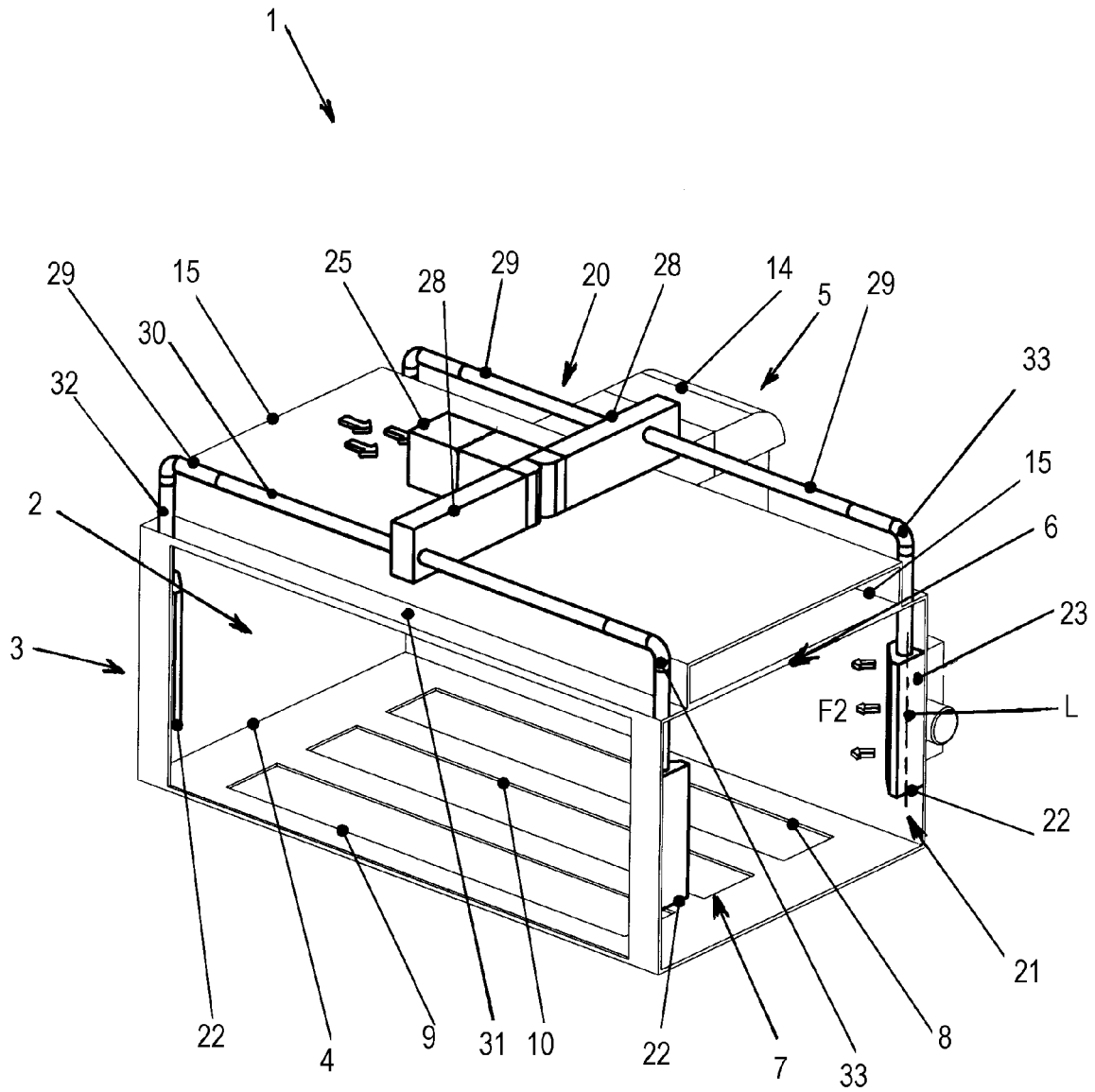


Fig. 2

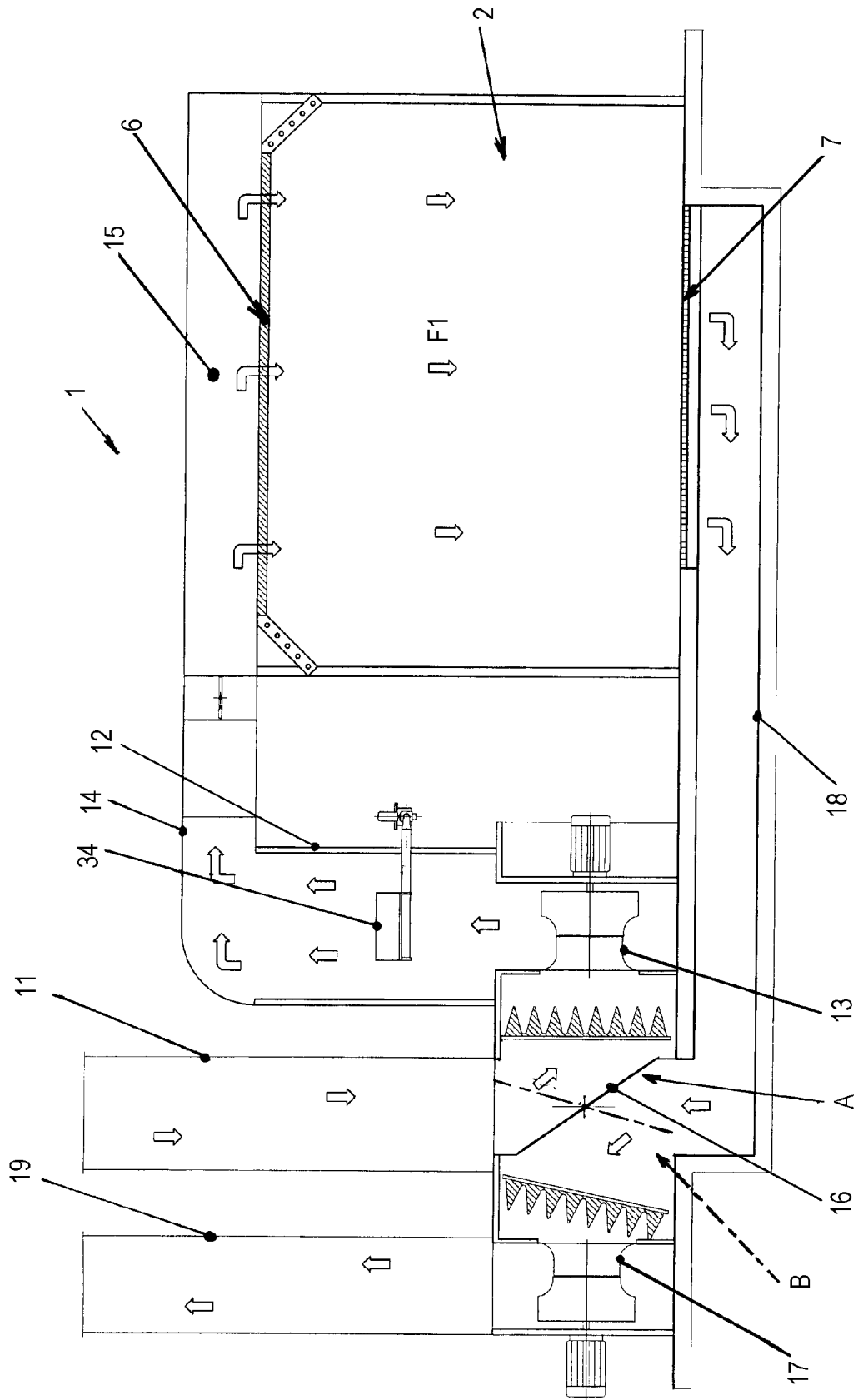
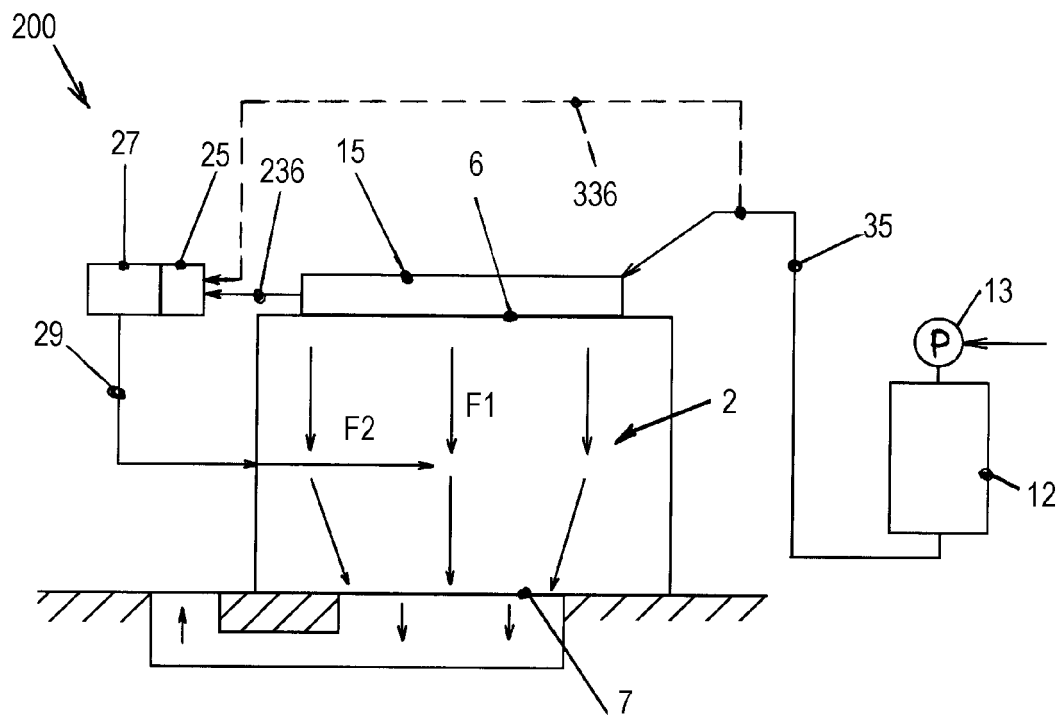
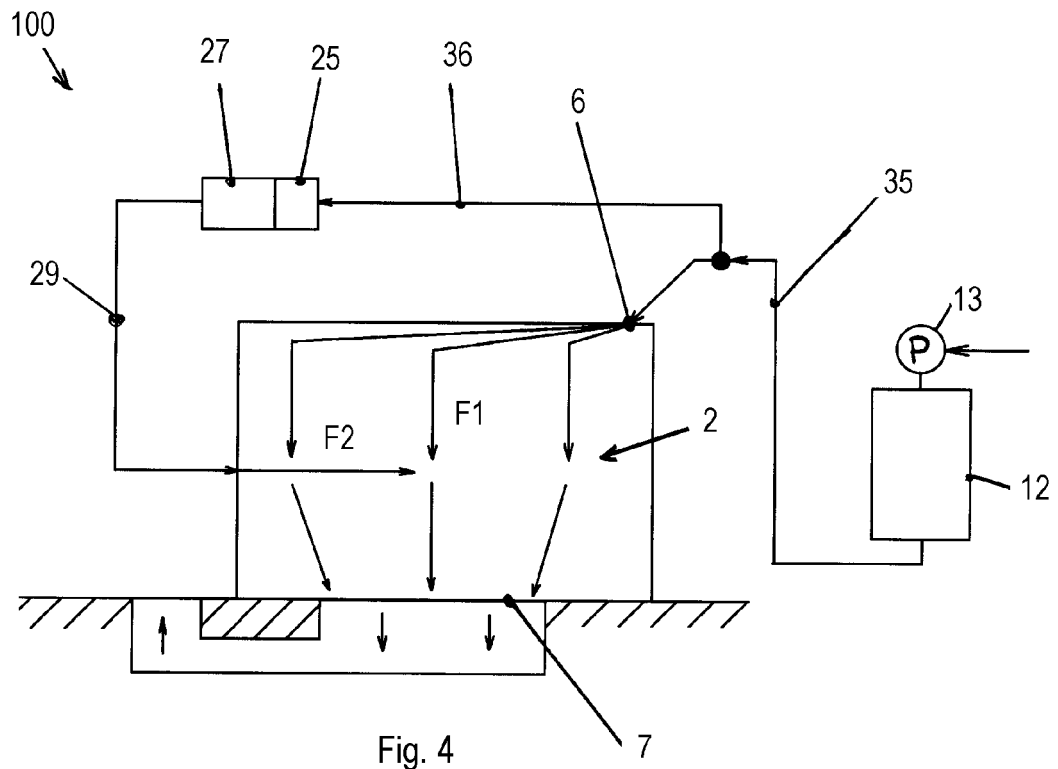


Fig. 3





EUROPEAN SEARCH REPORT

Application Number
EP 08 15 7002

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	US 5 875 565 A (BOWMAN BRADFORD K [US]) 2 March 1999 (1999-03-02)	1,4,6,7, 11,12	INV. F26B21/04
Y	* figures 1-8 *	2,3,5,8, 13-15,18	
	* column 1, line 4 - line 6 *		
	* column 2, line 51 - column 4, line 51 *		
	* column 5, line 24 - column 9, line 3 *		
	* column 9, line 48 - line 53 *		

Y	US 2004/148796 A1 (MORRISON NEIL [GB]) 5 August 2004 (2004-08-05)	2,3, 13-15,18	
A	* figures 1-4 *	1,6,11, 12	
	* paragraphs [0002], [0020] - [0025], [0056], [0077] - [0088] *		

Y	GB 2 168 473 A (TAIKISHA KK; HONDA MOTOR CO LTD) 18 June 1986 (1986-06-18)	5,8	
A	* figures 1,5,6,15 *	1,3,4,6, 7,13, 16-18	TECHNICAL FIELDS SEARCHED (IPC)
	* page 1, line 6 - line 22 *		F26B
	* page 2, line 112 - page 3, line 16 *		
	* page 3, line 54 - line 78 *		
	* page 5, line 5 - line 31 *		

A	US 1 854 789 A (GOSLINE DANIEL P) 19 April 1932 (1932-04-19)	1,3,4,6, 11-13	
	* figures 1-3 *		
	* page 1, line 54 - page 2, line 13 *		

A	US 2 037 559 A (BAROZZI GUIDO E) 14 April 1936 (1936-04-14)	1,4,5	
	* figures 1,2 *		
	* page 1, column 1, line 1 - line 5 *		
	* page 1, column 1, line 27 - page 2, column 1, line 57 *		

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The present search report has been drawn up for all claims			
5	Place of search The Hague	Date of completion of the search 8 December 2008	Examiner Hauck, Gunther
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			

EPO FORM 1503 03/82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 08 15 7002

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 113 600 A (TELCHUK STEVE E [US]) 19 May 1992 (1992-05-19) * figure 1 * * column 1, line 6 - line 9 * -----	1	
A	US 4 173 079 A (CRUFF CARLTON E [US] ET AL) 6 November 1979 (1979-11-06) * figure 4 * * column 1, line 10 - line 14 * * column 7, line 32 - line 51 * -----	16	
A	US 2005/210699 A1 (PHILIPPE SAVOIE [CA] ET AL) 29 September 2005 (2005-09-29) * figure 4 * * paragraphs [0001], [0027] * -----	16,17	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search		Date of completion of the search	Examiner
The Hague		8 December 2008	Hauck, Gunther
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

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EPO FORM 1503 03.82 (P04C01)

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

EP 08 15 7002

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
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08-12-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5875565 A	02-03-1999	NONE	
US 2004148796 A1	05-08-2004	NONE	
GB 2168473 A	18-06-1986	CA 1246859 A1 US 4664061 A	20-12-1988 12-05-1987
US 1854789 A	19-04-1932	NONE	
US 2037559 A	14-04-1936	NONE	
US 5113600 A	19-05-1992	NONE	
US 4173079 A	06-11-1979	NONE	
US 2005210699 A1	29-09-2005	NONE	