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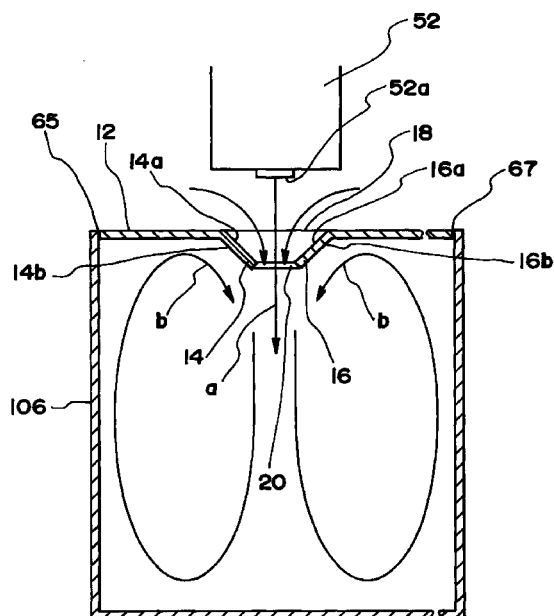
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(54) **Ink jet printer**

(57) An ink jet printer is proposed. In order to improve the cleaning qualities and to prevent an outflow of liquid from a liquid discharge vessel, two guide plates are provided which comprise tapered surfaces which project into the vessel.

FIG. 1



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Description

[0001] The present invention relates to ink jet printers, and more particularly to an ink jet printer for discharging ink from a nozzle of a recording head. In particular, the present invention relates to an ink jet printer according to the preamble of claim 1.

[0002] In JP - A - H8-112916, as shown in Fig. 4, an ink jet printer is disclosed in which a venturi passage 6 is provided in an upper part of a reservoir 4, and trial ink droplets discharged from a nozzle of a recording head 52 are to enter the venturi passage 6. The venturi passage 6 increases the velocity of an air current containing the ink by a theory of Bernoulli as the flow of the air containing small droplets of ink moves toward the reservoir 4 and lowers the static pressure. Accompanied by this phenomenon, a pressure slope is generated in the passage and the air containing the small droplet current is made to move in a direction of the flow and a direction of the reservoir. This flow toward the inside enables the adhesion of the mistlike fluid containing erroneously introduced ink small droplets that is called mist on the bottom surface of a recording head 8. When the mist adheres to the bottom surface of the recording head 8, an error is produced by the ink droplets at the time of plotting or printing which will result in a deterioration of the product quality of the plotting.

[0003] The conventional reservoir assembly is characterized in that as the small ink droplets in gas form accumulate in a large quantity in the lower part of the venturi passage 6, this flow of gas moves upward in the venturi passage 6, and when the flow of the small droplets discharged from the recording head 8 is slow, as shown with a numeral 10 in Fig. 4, it moves upward from an opening portion of the venturi passage 6 and adheres to the bottom surface of the recording head 8 as mist. Also, gaslike small ink droplets flow out through an opening formed between the reservoir 4 and the venturi passage 6 and can adhere to other portions of the printer which has been one of the problems of the prior art.

[0004] Object of the present invention is to solve or minimize the foregoing problems and to provide an ink jet printer with improved cleaning and/or printing quality.

[0005] The above object is achieved by an ink jet printer according to claim 1. A preferred embodiment is subject of the subclaim.

[0006] The present invention is to provide an effect that in case of performing a cleaning of a nozzle by discharging a liquid such as the ink or a cleaning liquid to an opening of a liquid discharge vessel from a nozzle of a recording head, it prevents the outflow of the liquid dropped into the liquid discharge vessel outside from the discharge opening again and prevents the discharged liquid from adhering to the nozzle of the recording head.

[0007] When the cleaning of the inside of the nozzle of the recording head is carried out, the recording head

shifts over a position immediately above the discharge opening of the liquid storing vessel disposed outside of a plotting range, and discharges the ink or the cleaning liquid from the nozzle of the recording head into the opening. A pair of guide plates is provided on an upper wall of the liquid storing vessel which has a tapered surface that projects into the inside of the upper wall and reduces the opposed interval downwardly, and the opposed portion of the guide plates forms the opening. In the upper part of the inside of the liquid discharge vessel, a fluid guiding surface is formed for guiding the flow of the liquid downwardly which is inclined in almost parallel to the tapered surface.

[0008] Further aspects, features and advantages of the present invention will be explained with reference to the enclosed drawing of a preferred embodiment. It shows:

Fig. 1 an explanatory drawing of the present invention;

Fig. 2 a general view of an ink jet printer;

Fig. 3 a piping explanatory drawing showing an ink supply system of the ink jet printer; and

Fig. 4 an explanatory drawing of the conventional technology.

[0009] In Fig. 2 reference numeral 22 denotes legs (illustration of the other leg is omitted) disposed at right and left of a base plate 26 of an ink jet printer 24, and the base plate 26 is fixed on the upper ends of the legs. The legs and the base plate 26 constitute a machine body of the ink jet printer.

[0010] A shaft holder 28 is fixed to the upper part of the legs 22 and an axial portion of a rolled paper holder 32 is rotatably and detachably journaled on the shaft holder 28. A roll portion 30a of a plotting medium 30 wound in roll form is detachably retained on the rolled paper holder 32.

[0011] A platen 34 (paper guide plate) is fixed to the base plate 26, and a guide roller 36 that has a width and a length identical with those of the plotting medium 30 extending in an X axis direction is disposed in the vicinity of an upper flow end of the platen 34. The guide roller 36 is disposed in the upper part of the roll portion 30a of the rolled paper 30, and both ends of the guide roller 36 are rotatably journaled on the base plate 26 by means of the bracket. Reference numeral 38 denotes a Y axis rail and is disposed horizontally in the upper part of the platen 34, and its both ends are journaled on the base plate 26 by means of the bracket.

[0012] A Y cursor 40 (carriage) is shiftably mounted on the Y axis rail 38, and the carriage 40 is connected to a Y axis drive device (illustration is omitted) disposed on the base plate 26 by means of a steel belt 42 spanned around pulleys or the like. A slit is formed on the platen

34 along the Y axis direction, and a drive roller 44 is disposed on the slit.

[0013] Both ends of the roller 44 are rotatably journaled on the base plate 26 by means of the bracket, and the drive roller 44 is connected to an X axis drive device (illustration is omitted) disposed on the base plate 26.

[0014] A pinch roller shaft 46 is liftably mounted on the Y axis rail 38 by means of a resilient mechanism (illustration is omitted), and pinch rollers 48 rotatably journaled on the pinch roller shaft 46 are arranged to be able to set in either condition, a condition where they are separated from the surface of the drive roller 44 and a condition where they are in resilient contact with the surface horizontally.

[0015] A head base 50 is fixed to one side of the carriage 40 and preferably four ink jet recording heads 52 provided with four nozzles 52a for four colors are mounted on the head base. The bottom surface on the four rows of the recording heads 52 which are mutually disposed in an identical plane is of an elongate rectangular shape, and on the bottom surface, nozzles 52a to which numerous ink discharge holes open in a row project slightly on the bottom surface.

[0016] Each of the four rows of the recording heads 52 is parallelly disposed mutually at a predetermined interval, and each bottom surface is arranged with an angle alpha to an X axis forming a right angle to the Y axis rail 38. On the other side of the carriage 40, sub-tanks 54 for solvent ink of four colors (black K, cyanogen C, magenta M, yellow Y) whose number is equal to those of the recording heads 52 are mounted, and three-way electromagnetic valves 56 are mounted on upper covers of the sub-tanks 54.

[0017] A sensor for detecting a level of the ink is mounted on each sub-tank 54. A liquid upper surface of the sub-tank 54 is disposed in the lower part of an ink discharge outlet of the corresponding recording head 52 in order to keep the inside of the ink supply path between the recording head 52 and the corresponding sub-tank 54, namely, the tube 53 at a negative pressure.

[0018] Reference numeral 58 denotes a main tank case disposed on the base plate 26, and main tanks 60 for solvent inks of four colors (three pieces are omitted from illustration), whose number of pieces is identical with those of the sub-tanks 54, as well as a cleaning liquid tank 62 are detachably housed in the main tank case. Each tank 60, 62 is constructed in such a way that the ink remaining quantity is detected by sensors 136, 138 (refer to Fig. 3) consisting of limit switches disposed underneath of each tank 60, 62.

[0019] The main tanks 60 and the sub-tanks 54 are respectively connected with a tube cable 122 by means of an electromagnetic valve. Reference numeral 64 denotes a supply control box mounted on the base plate 26, and is built in with a pump 66 and electromagnetic valves 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 101 as shown in Fig. 3, and is provided

with an electronic control circuit unit for controlling electronic equipments.

[0020] A controller (illustration is omitted) for controlling the X and Y axis drive devices and the recording heads 52 is mounted on the base plate 26 of the printer 24.

[0021] Reference numeral 2 denotes a wiping device for cleaning a nozzle peripheral portion of the bottom surface of the recording heads 52 and the discharge outlets of the nozzles 52a, and is arranged to be driven by a wiper motor 102 (refer to Fig. 3).

[0022] Reference numeral 106 denotes a liquid discharge vessel having alternately a rubber cap 108 for covering a discharge outlet of a nozzle 52a of a recording head 52 and a liquid discharge opening 110, and is disposed in a shifting range of the recording head 52 which is outside of the plotting or printing range of the base plate 26, and is liftable by a motor 112 (refer to Fig. 4).

[0023] Each cap 108 and the opening 110 of the liquid discharge vessel 106 are connected to a collecting pipe 120 fixed to the base plate 26 by means of the tube and the electromagnetic valve. Guide plates 14 and 16 are formed in reversed shape on an upper wall 12 of the liquid discharge vessel 106. The liquid discharge opening 110 is formed between the guide plates 14, 16 and tapered surfaces 14a, 16a of the upper surfaces of the guide plates 14, 16 are disposed between a wide width opening portion 18 of the upper part and a lower, narrow width opening 20 of the liquid discharge opening 110.

[0024] Fluid guide surfaces 14b, 16b inclined in V shape are formed on the lower surfaces of the guide plates 14, 16.

[0025] Alternatively, the guide plates 14, 16 could also form one truncated or conical wall extending into the vessel 106.

[0026] Small gaps or openings 65, 67 are formed between the upper wall 12 of the vessel 106 and the side wall.

[0027] Reference numeral 114 denotes a motor for stirring the liquid in the main tanks 60, and 116 denotes a waste liquid tank mounted at the legs 22, and 118 denotes a waste liquid tank.

[0028] The waste tank 118 is supported by a spring housed in the case 116, and is arranged to detect the waste liquid quantity by a sensor 134 (refer to Fig. 3) consisting of limit switches disposed between the bottom portion of the tank 118 and the upper surface of the case 116.

[0029] A rotor made of magnetic material is rotatably journaled on the bottom portion of each of the main tanks 60, and the rotor in the main tank rotates by the drive of the motor 114, and the ink in each of the main tanks 60 is arranged to be stirred. Each component part and the device are connected by piping with tubes as shown in Fig. 3. The recording head 52 is arranged to shift to a position immediately above the liquid discharge vessel 112 which is off the plotting range by the

shifting of the carriage 40 along the Y axis rail 38.

[0030] The operation of the preferred embodiment according to the present invention will be described in the following.

[0031] In order to set the plotting or printing medium 30 such as paper on the platen 34, the pinch rollers 48 are caused to elevate, and the plotting medium 30 is drawn out from the roll portion 30a and it is inserted between the drive roller 44 and the pinch rollers 48 through the guide roller 36, and thereafter, the pinch rollers 48 are caused to descend and the pinch rollers 48 are biased in resilient contact with the drive roller 44 from above the plotting medium 30.

[0032] By the foregoing operation, the setting of the plotting medium 30 is completed. When the printer 24 enters the plotting mode, the controller performs the ink filling operation, and thereafter, shifts to the plotting operation. When the plotting starts, a feed portion of the plotting medium 30 is carried in the X axis direction, namely, the arrow direction C over the platen 34 by an intermittent rotation of the drive roller 44 in the respective direction.

[0033] Also, the recording head 52 is operated on the basis of image information by the control of the controller, and discharges ink from the nozzles 52a, and scans or shifts along the plotting medium 30 along the Y axis by the reciprocating shifting of the carriage 40 along the Y axis rail 38, and visualizes the image information developed in the memory of the controller on the plotting medium 30.

[0034] When a piezo element of the recording head 52 or the like discharges the ink, the piezo element automatically absorbs or sucks the ink from the sub-tank 54. In this case, when the sub-tank 54 is not set at a negative pressure, the recording head 52 absorbs or receives ink excessively and the ink outflows. In order to set the sub-tank 52 at a negative pressure in this embodiment, the level of the bottom surface of the sub-tanks 54 is set lower than the discharge outlets of the recording heads 52.

[0035] When the plotting operation is completed, it is determined whether or not (enough) ink is present in the sub-tanks 54 by a signal of the sensor, and if it is judged that there is no ink, the printer 24 shifts to the ink makeup operation.

[0036] After the makeup of ink, or in case of the judgement that enough ink is present, a judgement is made as to whether or not a predetermined time has elapsed upon the plotting or a predetermined time has not elapsed upon the plotting, a judgement is made as to whether or not a predetermined time has elapsed upon completion of the plotting or in the standby condition, and if it is judged negatively, it returns to the plotting operation. Also, when it is judged affirmatively, it shifts to an ink recovery operation and a head cleaning operation sequentially.

[0037] The head cleaning operation will be described in the following.

[0038] In the first place, a judgement is made on the basis of a signal of a sensor 138 as to whether or not there is any remaining or a sufficient quantity in the cleaning liquid tank 62, and in case there is not any remaining or sufficient quantity, the display unit shows that there is not any remaining or sufficient quantity in the cleaning liquid tank and performs a processing for error. In case of the judgement that there is a remaining quantity, the recording head 52 shifts to a position immediately above the opening 110 of the liquid discharge vessel 106. Next, the electromagnetic valves 68, 70 are changed over in the pressure feeding direction.

[0039] Next, in the head cleaning operation, in order to arrange an execution of the pressure feeding of the cleaning liquid promptly, the cleaning liquid tank 62 is pressurized with the air for 60 seconds. This pressure operation is carried out by changing over the electromagnetic valves 72, 74, 76 disposed between the pump and the main tank in the direction of the cleaning liquid tank, and driving the pump 66 and feeding air into the cleaning liquid tank 62.

[0040] Next, the controller changes over the head air electromagnetic valves 74, 88, in the direction of the air feeding, and changing over the head electromagnetic valve 56 in the direction of the air feeding and driving the pump 66 and pressure feeding the air to the recording head 52 for 20 seconds.

[0041] With the foregoing pressure feeding, cleaning liquid is discharged from the nozzle 52a to the opening 110, and the inside of the recording head 52 is cleaned with the cleaning liquid. And then, the controller performs the pressure feeding of air to the recording head 52 for 30 seconds. Next, the controller shifts the recording head 52 to a position immediately above the wiping device to perform the wiping of the bottom portion of the recording head 52, namely, the wiping operation. And then, the controller performs the pressure feeding of cleaning liquid for 20 seconds to the recording head 52, and the cleaning liquid is discharged from the nozzle 52a to the opening 110.

[0042] Next, the controller sets the waste liquid tank 118 at a negative pressure for 5 seconds, and recovers the liquid accumulated in the collecting pipe 120. Next, the controller releases the cleaning liquid tank 62 to the atmosphere and cancels the pressure in the cleaning liquid tank 62.

[0043] In case of performing the discharge of ink, the controller drives the ink control unit of the recording head 52 and discharges ink from the nozzle 52a over the liquid opening 110 to prevent the nozzle 52a from being clogged.

[0044] When the nozzle 52a of the recording head 52 discharges the liquids such as ink or cleaning liquid over a location immediately above the opening 110 of the liquid discharge vessel 106, the liquid drops into the vessel 106 from the liquid opening 110 as shown with arrow a in Fig. 1. The liquid dropped into the vessel 106 becomes mist and accumulates in the bottom portion of

the vessel 106, and thereafter, it counterflows upward. The counterflowed fluid collides against the upper wall 12 and thereafter, it is guided by fluid guide surfaces 14b, 16b to move toward the bottom portion of the vessel 106 again, and circulates in the vessel 106.

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[0045] The fluid moving upward from the bottom portion of the vessel 106 by a circulation phenomenon of the fluid on account of the guiding action of the fluid guide surfaces 14b, 16b is guided in a direction being deviated from the opening 110, and seldom or practically never goes out to the outside through the opening 110. When the pressure in the liquid discharge vessel 106 increases by the gaslike fluid, this fluid is released to the outside through the gaps 65, 67. With the release of the fluid, it prevents the pressure in the liquid discharge vessel 106 from being elevated.

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[0046] The present invention is constructed as it being described in the foregoing, and when the cleaning of the ink passage of the recording head is performed, it can prevent the adherence of liquid containing ink in mist form over the nozzle of the recording head due to backsplashing of liquids from the liquid discharge vessel such as the ink for trial discharge or the cleaning liquid being discharged from the nozzle.

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Claims

1. Ink jet printer (24) with a recording head (52) which is shiftable to a position immediately above an opening (110) of a liquid storing vessel (106) disposed outside of a plotting or printing range so that ink and/or a cleaning liquid can be discharged into the opening (110) from a nozzle (52a) of the recording head (52) to clean the recording head (52) and/or prevent an ink passage of the recording head (52) from being clogged,
characterized in
 that a guiding means is associated to the opening (110) and extends into the vessel (106) forming an outer and an inner, preferably tapered or conical surface (14a, 14b, 16a, 16b).
2. Ink jet printer according to claim 1, characterized in that the guiding means is formed by two guide plates (14, 16) having tapered surfaces (14a, 16a) that project inside from an upper wall (12) of the vessel (106) diminishing its opposed distance or gap downwardly, and that fluid guide surfaces (14b, 16b) for guiding the flow of fluid downwardly are provided in the upper part of the inside of the vessel (106) and inclined at least substantially parallel to the tapered surfaces (14a, 16a).

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FIG. 1

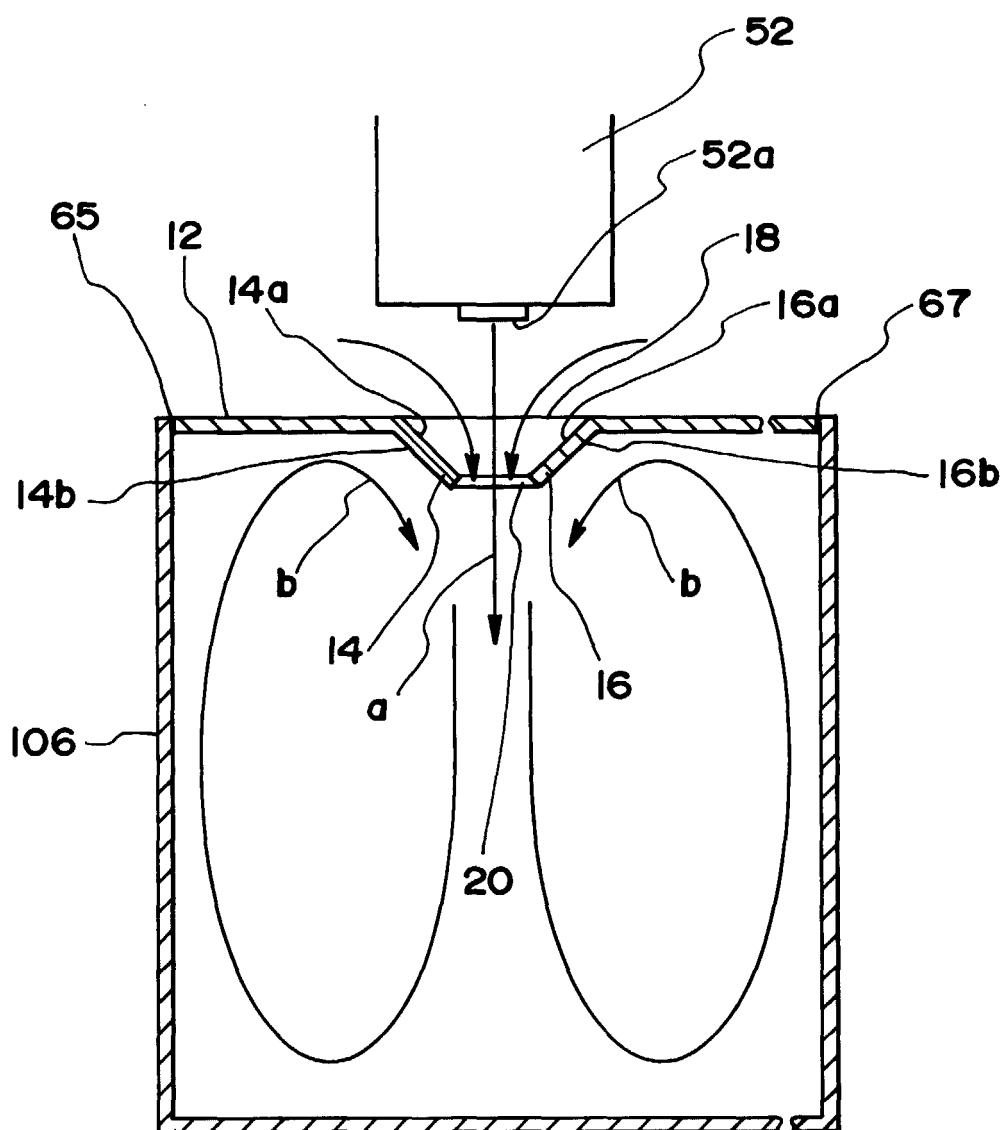


FIG. 2

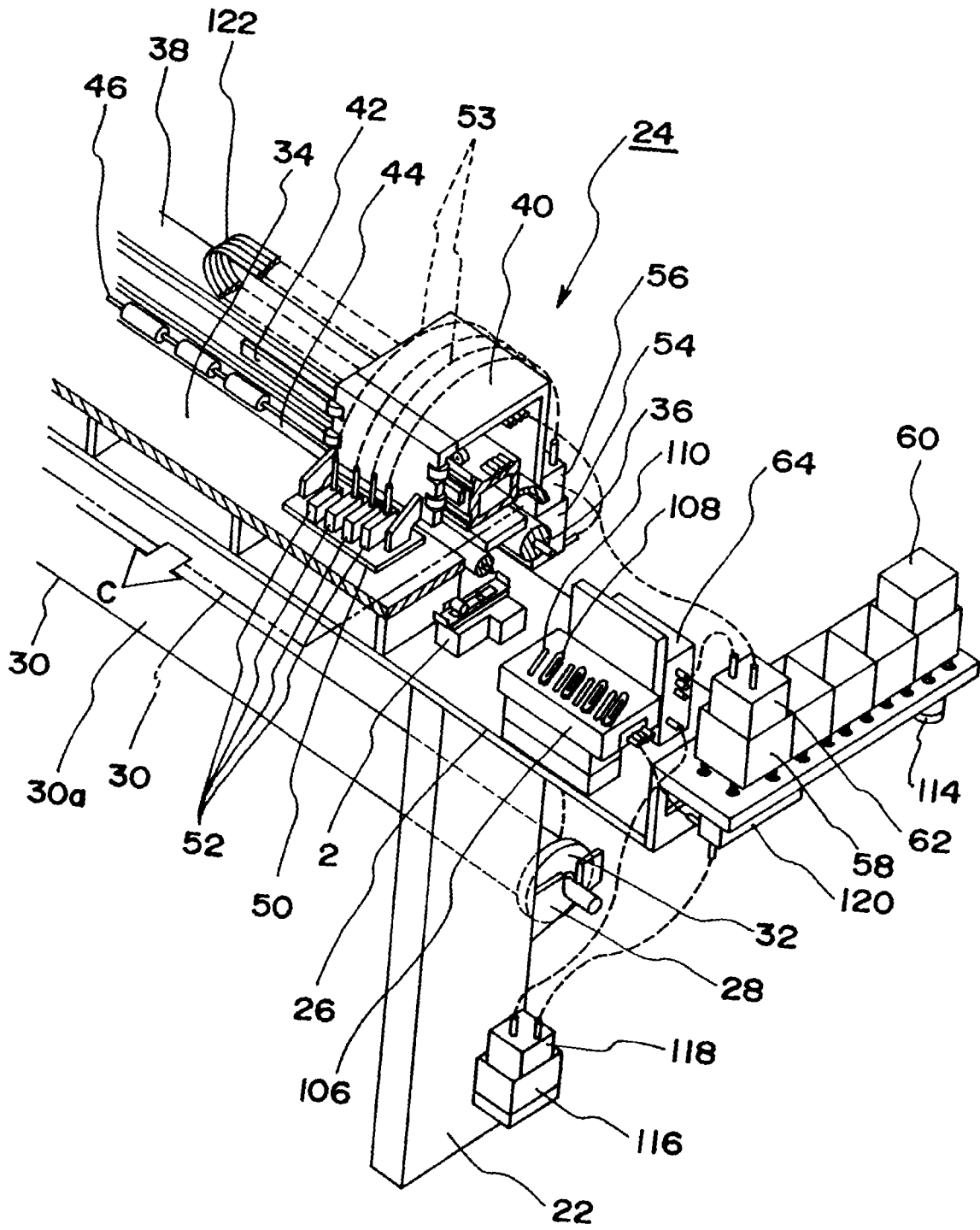


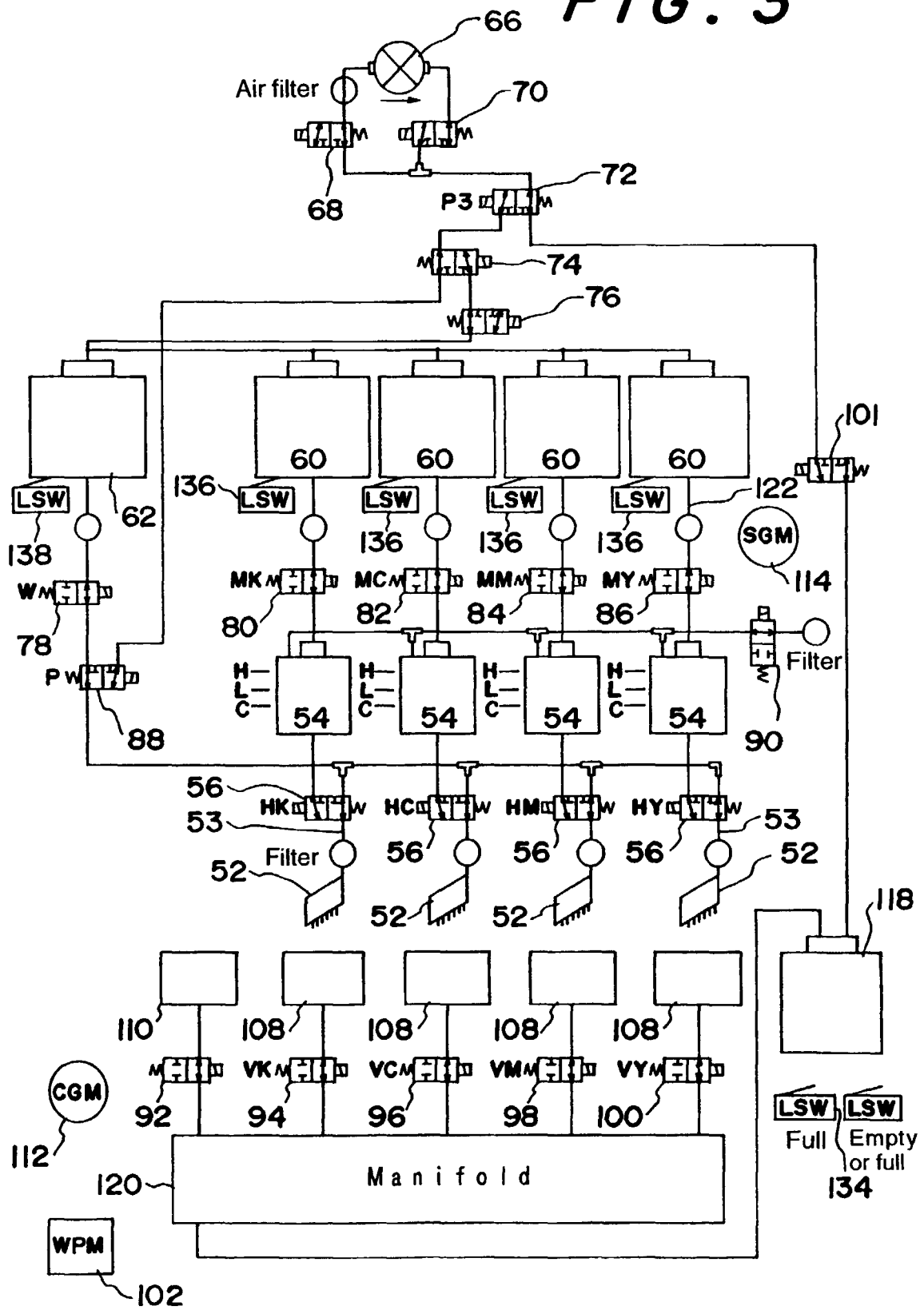
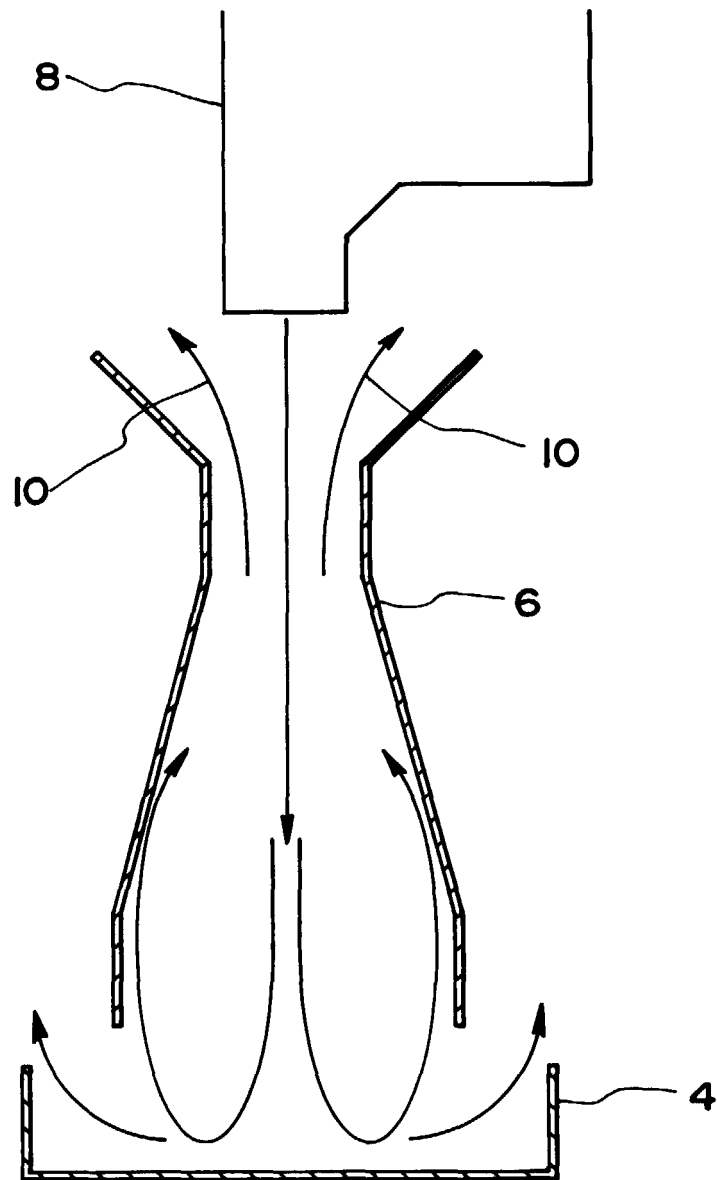
FIG. 3

FIG. 4





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EUROPEAN SEARCH REPORT

Application Number
EP 00 11 5558

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
A	EP 0 705 699 A (HEWLETT PACKARD CO) 10 April 1996 (1996-04-10) * the whole document *	1	B41J2/165
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			TECHNICAL FIELDS SEARCHED (Int.CI.7)
			B41J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 October 2000	Examiner De Groot, R
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 11 5558

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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23-10-2000

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