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

(11) EP 1 310 367 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.05.2003 Bulletin 2003/20

(51) Int Cl.[7]: **B41J 2/165**

(21) Application number: **01000604.7**

(22) Date of filing: **08.11.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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(54) Service station for inkjet printing system

(57) A service station (1) is provided for an inkjet printing system.

The service station (1) comprises an enclosure (2), a wiper system (5) for wiping the print head and a scraper (9) for cleaning the wiper blades (6) of the wiper system (5). Cleaning of the wiper system (5) by passing the scraper (9) is done inside the enclosure (2).

The service station (1) is easily replaceable allowing easy and total replacement of all the cleaning elements and removal of ink residue and other impurities upon replacing the print head or changing the colour or type of ink.

Contamination of the printing system by ink residue is avoided.

Also an external driving source (14) is provided for actuating the cleaning system inside the service station (1).

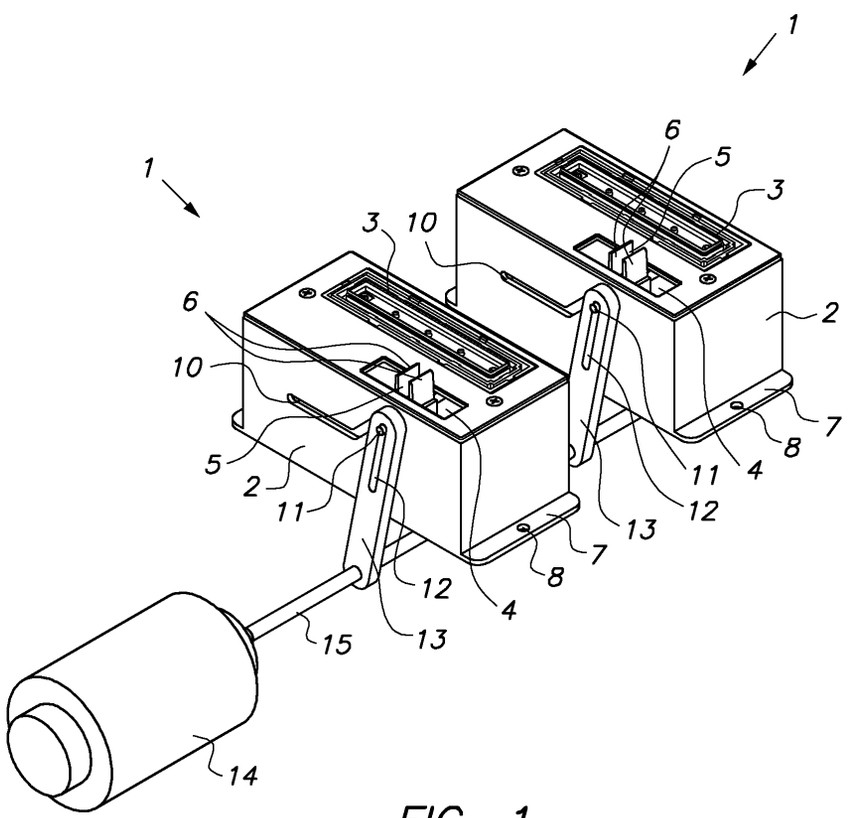

FIG. 1

EP 1 310 367 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to inkjet printing mechanisms, such as printers or plotters.

[0002] More particularly the present invention relates to a replaceable service station for cleaning an inkjet print head.

BACKGROUND OF THE INVENTION

[0003] Nowadays inkjet printing systems are used in a wide array of apparatuses in a wide array of applications such as fax, colour photo printing, industrial applications etc. In these printing systems inks, possibly of various colours, is ejected out of an array of nozzles located in a print head to the receiving material. A long known problem in inkjet printers is that the nozzles through which the ink is projected to the receiving material are blocked by clogging of ink inside the nozzles and on the print head. This renders certain nozzles inoperable and results in a defective print of deteriorated print quality.

To improve the clarity and contrast of the printed image, recent research has been focused to improvement of the used inks. To provide quicker, more waterfast printing with darker blacks and more vivid colours, pigment based inks have been developed. These pigment-based inks have a higher solid content than the earlier dye-based inks. Both types of ink dry quickly, which allows inkjet printing mechanisms to forms high quality images.

In some industrial applications, such as making of printing plates using ink-jet processes, inks having special characteristics causing specific problems. E.g. UV curable inks exist to allow rapid hardening of inks after printing.

The combination of small nozzles and quick drying ink leaves the print heads susceptible to clogging, not only from dried ink and minute dust particles or paper fibres, but also from the solids within the new ink themselves.

[0004] It is known to counteract or correct the problem of clogging by protecting and cleaning the print head by various methods.

- Capping : during non-operational periods the print head can sealed off from contaminants and prevents drying of the ink. To enhance priming when printing starts, it is possible to apply a vacuum to the print head through the capping unit for clearing the nozzles.
- Spitting or Priming: by periodically firing a number of drops of ink through each nozzle into a waste ink receiver, commonly called a spittoon, clogs are cleared from the nozzles.
- Wiping : Before an during printing the inkjet print head is wiped clean by using an elastomeric wiper, removing ink residue, paper dust and other impurities.

Also other methods exist for cleaning an inkjet print head which may include applying solvents as in EP-A-1 018 430 ,

[0005] These features designed to clean and to protect a print head , are commonly concentrated in a service station which is mounted within the plotter chassis, whereby the print head can be moved over the station for maintenance. An example of such a service station can be found in US-A-6 193 353 combining wiping, capping and spitting functions.

[0006] A known problem using wiping systems is that the wiper itself becomes contaminated with ink residue and dust. This decreases the wiping efficiency and may even cause damage to the print head.

For removal of contaminants from the wiper, the wiper blade is dragged into contact with a scraper.

Also other methods for cleaning the wiper can be used.

- Use can be made of a sponge-like member for cleaning the wiper
- To facilitate removal of contaminants of the wiper, e.g. ultrasonic waves can be used.

[0007] In some prior art embodiments the scraper is mounted on the plotter chassis, while the service station is located on a movable sled. A similar embodiment can be found in US-A-6 155 667.

[0008] A problem which is not addressed in the prior art is that during cleaning of the wiper, the impurities, scraped off, will contaminate the surrounding area inside the plotter.

[0009] Also ink sputtering will happen when the wiper blade touches the scraper and even so when the wiper blade is jumping back to its vertical position after release.

[0010] Another non-addressed problem is that the impurities which build up on the wiper/scraper system can contaminate the print head, especially when changing to another colour or to another type or ink. A residue of the old ink collected on the wiper and scraper from previous printing and cleaning actions can be deposited on the print head causing contamination of the new ink by old residue causing colour deviations of the newly printed image or leading to problems caused by e.g. chemical incompatibility of the old and new inks.

[0011] The internal contamination can result in deteriorated printing quality and extra need for maintenance for cleaning the inside of the inkjet printing mechanism. A need exists to enable easy and complete changing of the print head cleaning system.

[0012] Another problem is that the efficiency of the scraper will decrease in time due to dried ink deposals on the scraper tip. Periodically the scraper has to be cleaned or replaced.

OBJECTS OF THE INVENTION

[0013] It is an object of the present invention to provide a service station for use in an inkjet printer causing less contamination inside the printing engine.

[0014] It is a further object of the invention to provide a service station which can be easily replaced upon changing the printhead or printing colour.

[0015] It is a further embodiment of the invention to provide efficient removal of accumulated residue form the inkjet printing system

SUMMARY OF THE INVENTION

[0016] The objects of the invention are realised by a service station having the specific features of claim 1. Specific features of preferred embodiments are set out in the dependent claims.

[0017] A method for cleaning a wiper of a service station is set out in claim 12.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 shows service stations according to the present invention in a dual head printer.

Fig. 2A illustrates a service station according to the invention with a retraction mechanism for the wiper system with the wiper system in wiping position.

Fig. 2B illustrates the service station with the wiper system in retracted position with the wiper blades in a position past the scraper.

Fig. 3 shows the actuation of the moving mechanism of a possible embodiment according to the invention by an external motor during cleaning of the wiper.

Fig. 4 shows an embodiment having plural service stations wherein the wipers are mounted on an axis.

Fig. 5A shows a possible embodiment of a cleaning station wherein a rotational movement is used for cleaning the wiper.

Fig. 5B shows the the position of the rotatable wiper system after rotation past the scraper.

Fig. 6 illustrates the rotation of the wiper by the external motor.

Fig. 7 depicts a service station with means for removing residue from the enclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0019] While the present invention will hereinafter be described in connection with preferred embodiments thereof, it will be understood that it is not intended to limit the invention to those embodiments.

[0020] Fig 1 depicts dual service stations 1 according to the present invention. When using a single print head only one station is needed. In a printer using several print heads plural cleaning stations can be provided. Each service station 1 comprises an enclosure 2, a capping system 3 for covering the ink jet print head (not shown) during non printing periods. On the upper side of the enclosure 2 is provided an aperture 4 shown with a protruding wiper system 5 in the operable position, consisting of two wiper blades 6. During wiping of the print head (not shown) the wiper system 5 is dragged in contact along the print head whereby ink residue and other impurities are collected by the wiper blades 6.

[0021] The enclosure 2 can be executed in all sorts of material.

Preferably use is made of a plastic material so that the enclosure 2 or its parts may be cheaply made by e.g. an injection-moulding technique. The enclosure 2 can be completely closed but can also be partially open. The enclosure 2 is provided with a system enabling easy mounting and removal of the service station 1 in the printer. In Fig 1 the service station 1 is provided with a mounting plate 7 with mounting holes 8 enabling easy mounting of the service station 1 using e.g. screws or other means for fastening. Other systems such as clip-on systems, clamps etc. can also be used.

[0022] The wiper blades 6 are preferably made from an elastomeric material in order to ensure good contact with the print head during wiping. The hardness of the wiper blades 6 is preferably within the range of 60-80 Shore A. The tip op the wiper blades 6 may be asymmetrical or grooved in order to provide good wiping of the print head and efficient collection of the ink residue and impurities.

[0023] The orientation of the wiper blades 6 may be perpendicular to the wiping direction of the wiper system 5. In an alternative configuration at least one of the wiper blades 6 is mounted at an oblique angle to the wiping direction propagating the collection of impurities at the trailing edge of the wiper blade 6.

[0024] In following description reference is made to Fig. 2A en 2B depicting a section of the servicing station 1.

Inside the enclosure 2 of the service station 1 is provided a scraper 9 for cleaning the wiper blades 6. The scraper 9 can be integrated at the inside of enclosure 2. The scraper 9 is positioned at a lower level inside the service station 1, so that the cleaning operation is completely realised internally in the service station 1. The scraper 9 can be constituted in the same material as the enclosure 2 itself and can even be manufactured during the same production process. Other materials can be used, while also various methods for mounting the scraper 9 inside the enclosure 2 are possible. Preferably the part of the scraper 9 contacting the wiper blades 6 has the shape of a wedge so that impurities are removed from the wiper blades 6 by a sharp edge of the wedge.

[0025] Fig 1 to 3 show a system wherein the cleaning of the wiper blades 6 is done by a retraction movement of the wiper system 5 into the enclosure 2 followed by a translation movement past the scraper 9 for removing

an excess of impurities from the wiper blades 6.

A possible mechanism comprises a slit 10 provided in at least one side of the enclosure 2 and a wiper system 5 coupled to a slider 11 for sliding in the slit 10 of the enclosure Preferably two slits 10 are provided in opposite walls of the enclosure 2 to ensure.

The slider 11 is also provided for sliding into a second slit 12 which is provided into a lever 13 for actuating the cleaning mechanism and is coupled to a driving force 14, e.g. an electrical motor 14 which is preferably provided externally of the service station 1.

The coupling of the lever 13 with the driving force 14 can be done by an axis 15. A single motor 14 and axis can be provided for all service stations.

[0026] By rotation of the axis 15 induced by the driving motor 14 slider 11 is forced to follow the slit 10 in the enclosure 2. Thus the wiper system 5 is retracted inside the enclosure 2 of the service station 1 and translated inside the enclosure 2 whereby the wiper blades 6 are translated past the scraper 9 thus removing accumulated impurities from the wiper blades 6. The translation movement of the wiper system 5 along the scraper 9 has a typical speed of 0.05-0.2 m/sec. By the enclosure 2 enclosing scraper 9 en wiper system 5 during the cleaning operation, contamination of the printing engine itself is avoided. Scraped of ink residues and other impurities are collected inside the enclosure 2 of the service station 1. Even impurities propelled away during recoil of the elastomeric wiper blades 6 when clearing the edge of the scraper 9 can not reach the interior of the printer itself.

[0027] During the scraping operation a relative movement between the scraper 9 and the wiper system 5 is necessary. This means that it possible that instead of the wiper system 5 moving past the scraper 9, it is also possible that the scraper 9 moves along the wiper system 5 or even a combined movement of both relative to each other will perform the cleaning of the wiper blades 6 by the scraper 9.

[0028] After the wiper system 5 has passed the scraper 9, the wiper system 5 can be moved backwards along the scraper 9 cleaning the other side of the wiper blades 6 and moving the wiper system 5 back to the aperture 4 ready to be used again for a next wiping action of the print head

[0029] In the described embodiment the movement of the wiper system 5 relative to the scraper 9 is a translation.

[0030] In another possible embodiment depicted in Fig. 4 to 6, the cleaning of the wiper blades 6 is conducted in another way.

The wiper system 5 is coupled to a rotation axis 16 provided with a gear 17 which is coupled to a second gear 18, which may be only a segment of a complete gear, coupled to a rotation axis 15 which is coupled to a driving force 14. In order to clean the wiper blades 6 a rotation movement of the gear segments 18 cause rotation of the wiper system 5 to the inside of the service station 1 and at the same time bringing the wiper blades 6 into contact with the scraper 9 mounted inside the enclosure 2 at the opposite side of the wiper system 5. In this embodiment the transporting of the wiper system 5 into the enclosure 2 of the service station 1 at the same time also provides the rotational movement for cleaning the wiper blades 6 as can be seen in Fig. 5B. Ink residue and other impurities are scraped off by the scraper 9 and are collected in the enclosure 2. This cleaning can also be done in two directions, effectively cleaning both sides of the wiper blades 6.

[0031] It is also possible to design various alternative embodiments providing a relative movement of the wiper system 5 to the scraper 9 or cleaning system providing translation or rotational movement. Complete separate systems can be used for retracting the wiper unit 5 inside the enclosure 2 and for scraping the wiper blades 6 along the scraper 9. Above mentioned examples are merely possible embodiments of the present invention. Further mechanisms for generating the movement of the wiper blades 6 or the scraper 9 are not described in this document because a lot of already existing concepts are available : gear wheels, levers, motors, etc...

[0032] As already mentioned above the system has certain advantages :

- During cleaning of the wiper blades 6, no ink drops or impurities can contaminate the surrounding area in the plotter.

- Particles (dried ink, impurities, paper dust, ...) that are scraped of, will drop by gravity into the bottom of the inside of the service station 1.

- Ink droplets, generated during unbending of the elastomeric wiper blades 6 when loosing contact with the scraper 9, will be captured by the side walls of the enclosure 2 of the service station 1. For this the orientation of the scraper 9 and the wiper system 5 are important and have to be preferably vertical.

- As indicated above, the service station 1 contains all cleaning elements such as the wiper system 5 and scraper. Also the capping system (3) can be integrated into the service station (1). No other cleaning elements are needed outside the service station 1. By replacing the service station 1, all the impurities that were scraped off and all involved cleaning elements are removed from the printer or plotter. When simultaneously changing the service station 1 upon changing a print head or changing the colour or type of ink, no residue is left over capable of contaminating the printer or print head. These impurities are enclosed in the enclosure 2 of the service station 1. So no special cleaning of the printer or plotter is required upon changing the print head or type of ink.

Even changing of colour is thus possible without fearing contamination of one colour with another.

- Together with the service station 1 wiper system 5, scraper 9 and capping system (3) are replaced simultaneously. Both elements have a limited lifetime and should be replaced periodically. Replacing simultaneously these elements guaranties high efficiency of cleaning.

[0033] In another preferred embodiment the service station 1 is provided with means for collecting and removing residue from the service station 1. This enables the removal of impurities during the lifetime of the service station 1. A possible embodiment is shown in Fig. 7 wherein at the underside of the enclosure 2 a drawer 19 is provided for regularly removing the collected residue. If possible the scraper 9 or alternative cleaning systems for the wiper blades 6 is mounted on the drawer which enables easy maintenance of the cleaning system.
The embodiment comprising a drawer 19 is preferable because it is a relative cheap and simple system. Other system for collecting residue can be used, even comprising moving parts such as moving belts, etc...

[0034] Because the cleaning of the wiper blades 6 involves generation of a movement of the wiper system 5, either in the form of a movement and/or rotation, a driving source 14 is necessary. This can be provided with e.g. an internal motor inside the service station 1. Also other driving means can be used. E.g. solenoid actuators etc... When using a replaceable service station 1 the driving force 14 is preferably located outside the service station 1 as shown in Fig. 1,3,4 and 6 and the a coupling of the external driving force 14 with the internal mechanisms is provided using gears, levers, clutch system, etc...
It can be seen that when exchanging a service station 1 in the inkjet printer, the relative expensive external motor need not to be exchanged thus making the exchangeable unit cheaper.
As can be seen in Fig. 1,3,4 and 6, it is also relatively simple to provide a single driving force 14 or motor for several cleaning stations serving different print heads. This is considerately cheaper than providing separate motors.

[0035] More complicated embodiments wherein not only the wiper system 5 is transported into the enclosure 2, but also the cleaning system (scraper 9) is transported into the enclosure 2 before cleaning the wiper blades 6 can be construed.
Possible embodiments include the enclosing of the wiper system 5 and cleaning system by surrounding them by a moving enclosure.

[0036] Having described in detail preferred embodiments of the current invention, it will now be apparent to those skilled in the art that numerous modifications can be made therein without departing from the scope of the invention as defined in the appending claims.

Parts list

[0037]

1. service station
2. enclosure
3. capping system
4. aperture
5. wiper system
6. wiper blades
7. mounting plate
8. mounting hole
9. scraper
10. slit in enclosure
11. slider
12. slit in lever
13. lever
14. motor
15. driving axis
16. rotation axis of wiping unit
17. gear
18. gear segment
19. drawer

Claims

1. Service station (1) for an inkjet printing apparatus having an inkjet print head comprising :

- an enclosure (2);
- a wiper system (5) for wiping said inkjet print head;
- a cleaning system for cleaning said wiper system (5); **characterised in that** said enclosure (2) is for enclosing said wiper system (5) and said cleaning system during said cleaning of said wiper system (5).

2. The service station (1) according to claim 1 wherein said wiper system (5) comprises at least one wiper blade (6).

3. The service station (1) according to claim 2 wherein said cleaning system comprises a scraper (9) for cleaning said wiper system (5) by a relative movement between said wiper system (5) and said scraper (9) in contact with said wiper blade (6).

4. The service station (1) according to claim 3 further comprising means (10, 11, 12, 13, 15) for generating a relative translating movement between said wiper system (5) and said scraper (9).

5. The service station (1) according to claim 3 or 4 further comprising means (15, 16, 17, 18) for generating a relative rotational movement between said wiper system (5) and said scraper(9).

6. Service station (1) according to any one of the preceding claims further comprising transportation means for transporting said wiper system (5) to the inside of said enclosure (2).

7. Service station (1) according to claim 6 when dependent on claim 5 wherein said transporting means is said means for generating a rotational movement.

8. The service station (1) according to any one of the preceding claims wherein the cleaning system is inside the enclosure (2).

9. Service station (1) according to any one of the preceding claims wherein said service station (1) is for collecting residue generated by cleaning the wiper system (5) and wherein said service station (1) further comprises means (19) for collecting and removing said residue from said enclosure (2).

10. Service station (1) according to any one of the claims 4 to 9 wherein said service station (1) is coupled to a external driving means (14) for driving said means (10, 11, 12, 13, 15, 16, 17, 18) for generating said movement or said transportation means.

11. Service station (1) according to any one of the preceding claims where the service station (1) is replaceable.

12. Method for cleaning a wiper system (5) of a service station (1) in an inkjet print head, the service station (1) comprising a cleaning system and an enclosure (2) comprising the steps of:

- transporting said wiper system (5) to the inside of said enclosure(2),
- cleaning said wiper system (5) by the cleaning system inside the enclosure (2).

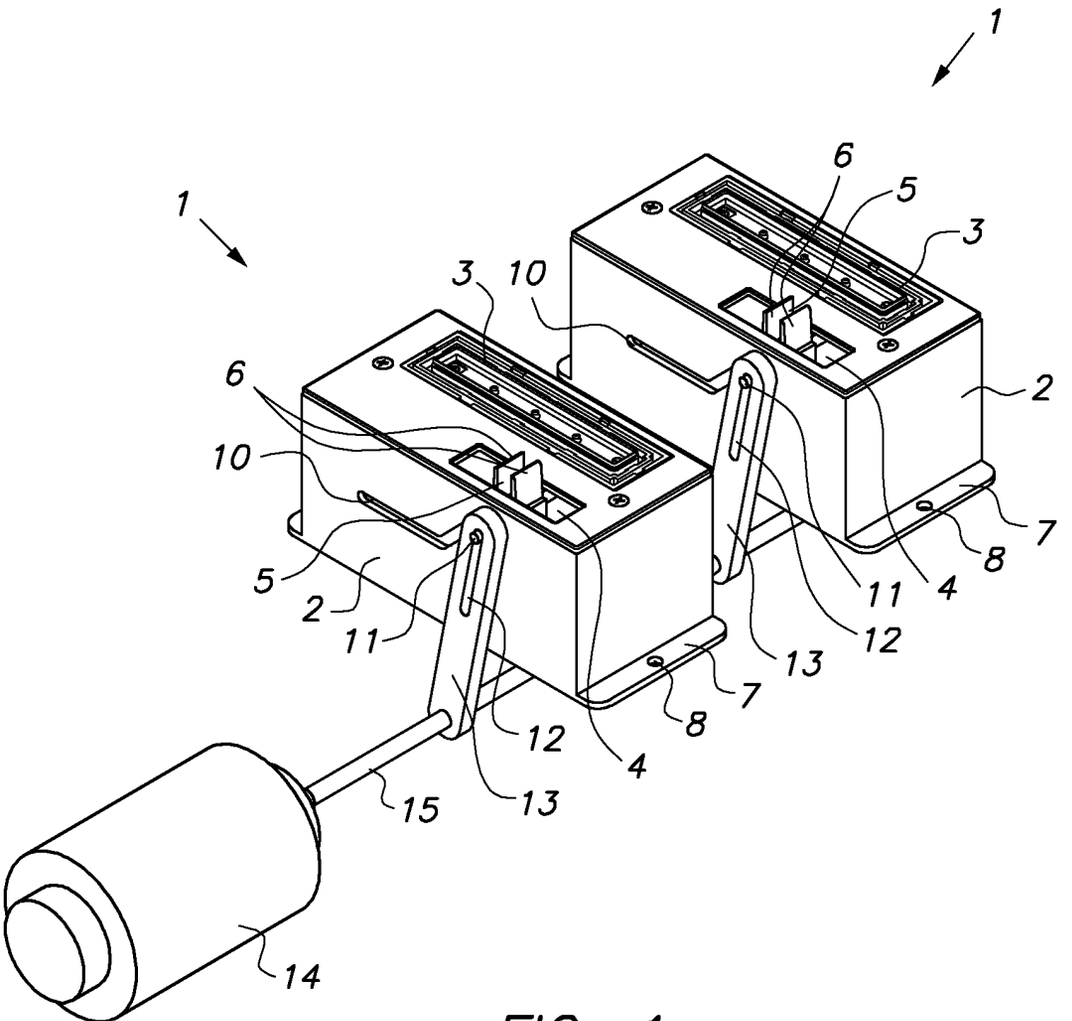

FIG. 1

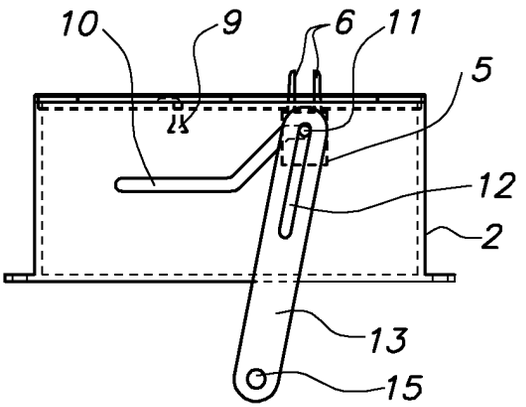

FIG. 2A

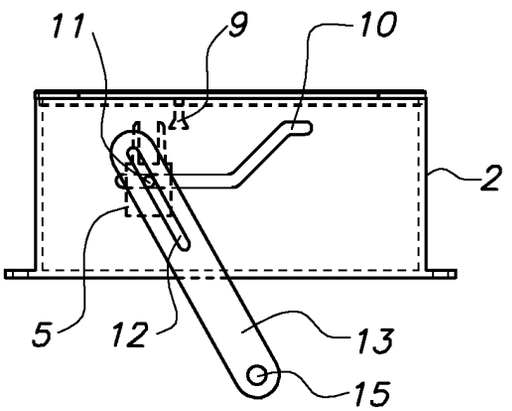

FIG. 2B

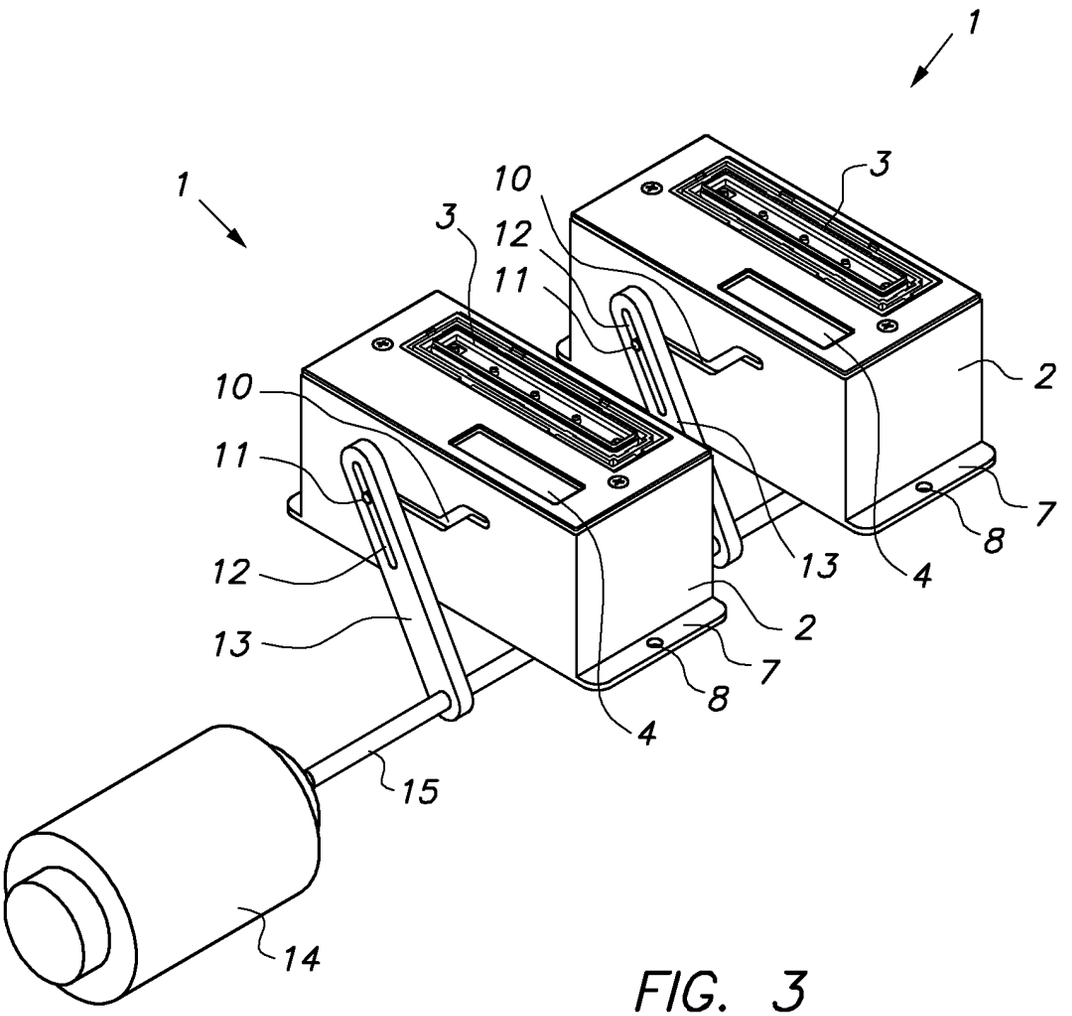

FIG. 3

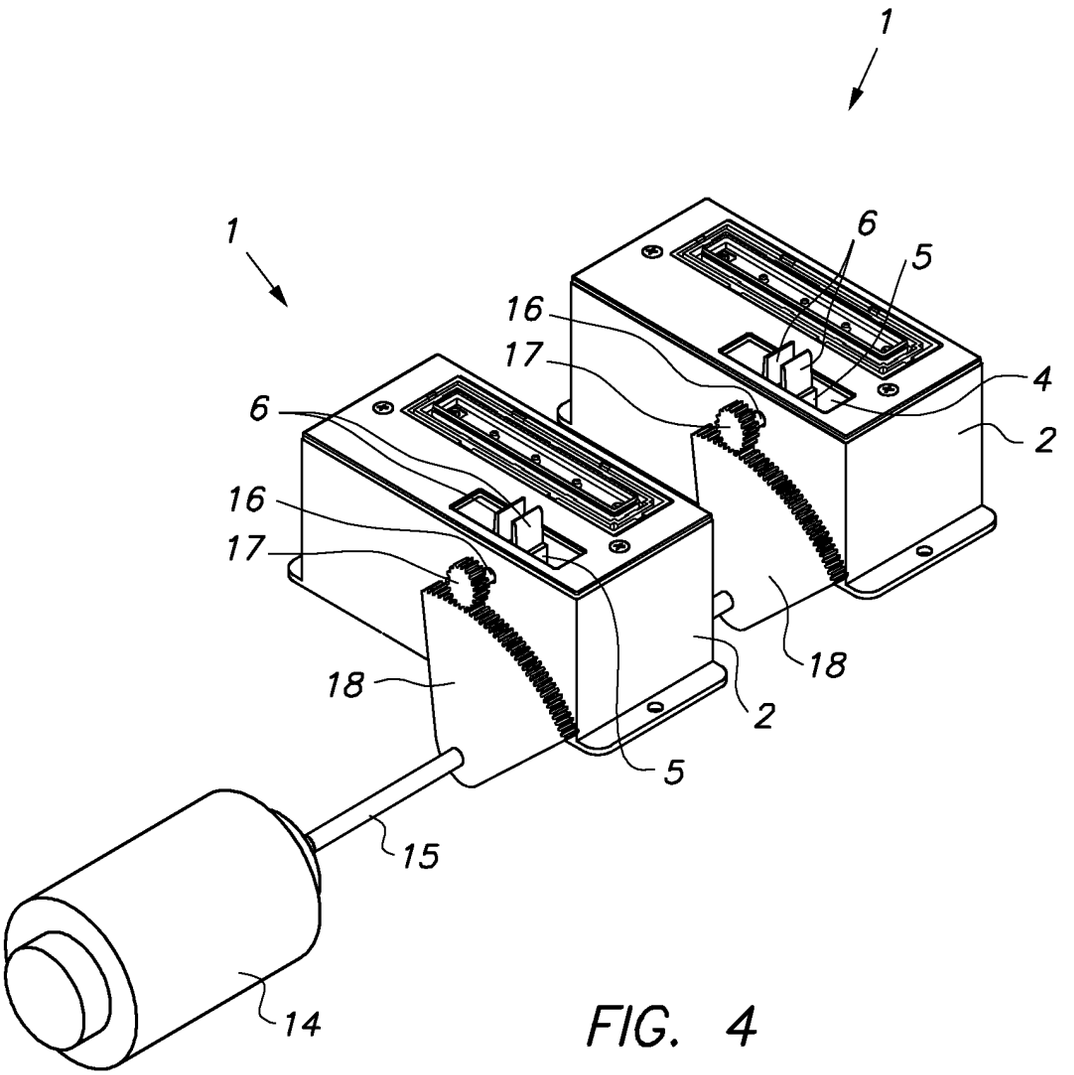

FIG. 4

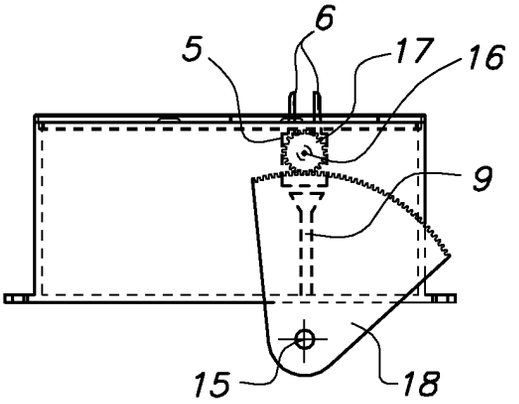

FIG. 5A

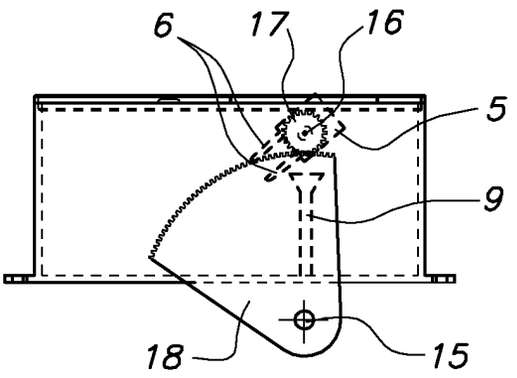

FIG. 5B

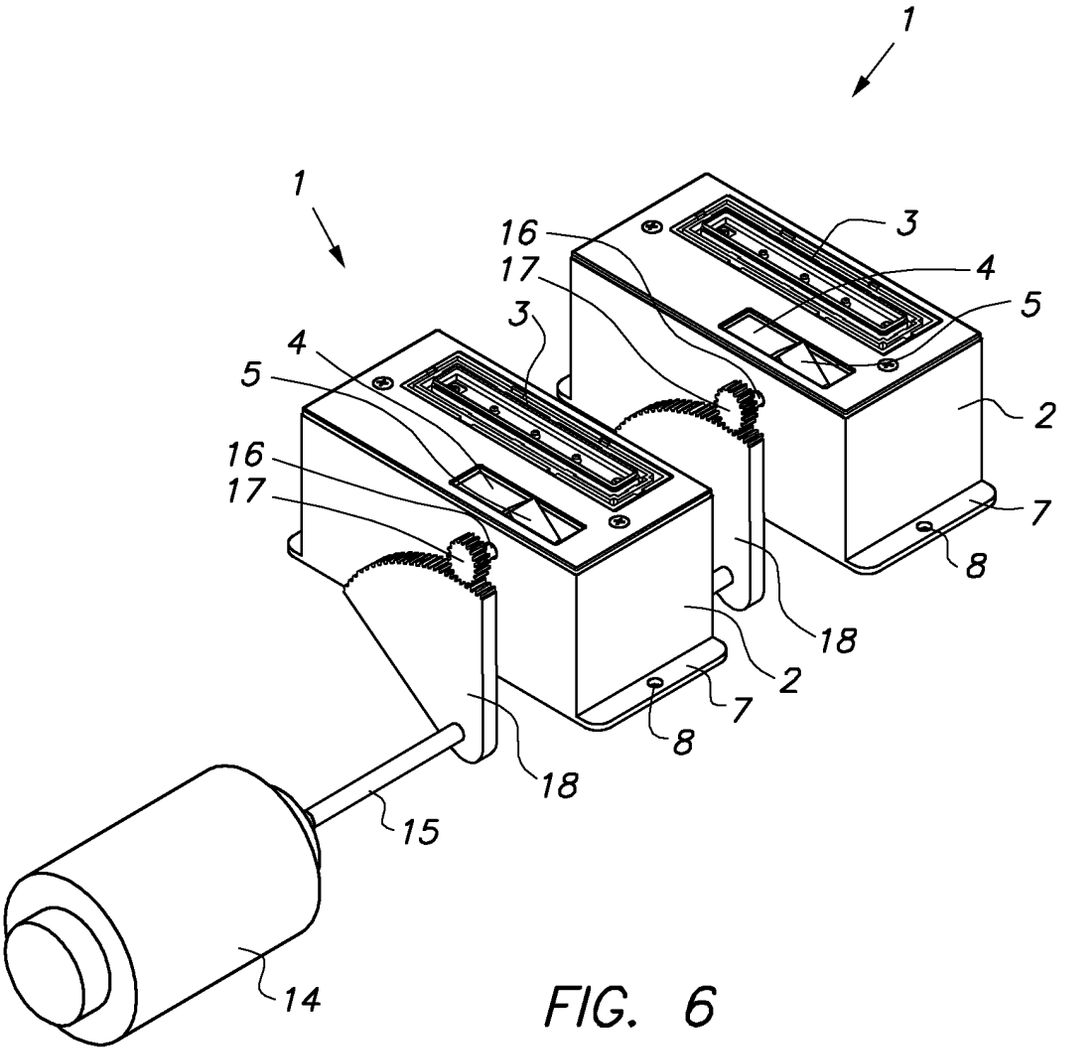

FIG. 6

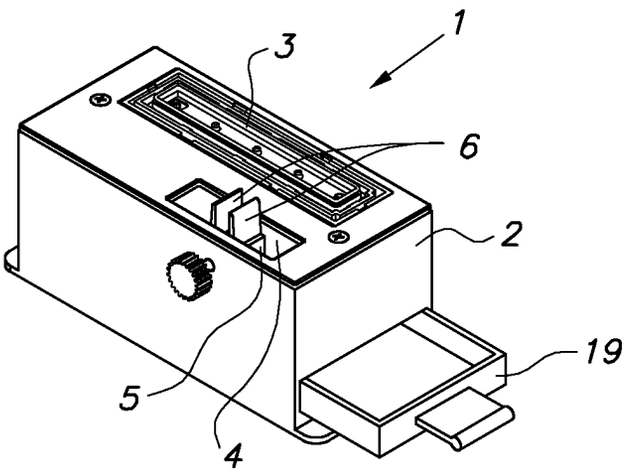

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 00 0604

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	* column 7, line 8 - column 13, line 4; figures *	5,7,9	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 April 2002	De Groot, R

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 00 0604

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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22-04-2002

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