



(11)

EP 2 621 728 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.02.2019 Bulletin 2019/07

(51) Int Cl.:
B41J 2/145^(2006.01) B41J 29/00^(2006.01)

(21) Application number: **10857627.3**

(86) International application number:
PCT/AU2010/001292

(22) Date of filing: **01.10.2010**

(87) International publication number:
WO 2012/040765 (05.04.2012 Gazette 2012/14)

(54) INKJET PRINTHEAD HAVING COMMON CONDUCTIVE TRACK ON NOZZLE PLATE

TINTENSTRAHLDRUCKKOPF MIT GEMEINSAMER LEITENDER SPUR AUF EINER
DÜSENPLATTE

TÊTE D'IMPRESSION À JET D'ENCRE AVEC UNE PISTE CONDUCTRICE COMMUNE SUR LA
PLAQUE À BUSES

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

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(43) Date of publication of application:
07.08.2013 Bulletin 2013/32

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Description

Field of the Invention

[0001] The present invention relates to the field of printers and particularly inkjet printheads. It has been developed primarily to improve print quality and printhead performance in high resolution printheads.

Background of the Invention

[0002] Many different types of printing have been invented, a large number of which are presently in use. The known forms of print have a variety of methods for marking the print media with a relevant marking media. Commonly used forms of printing include offset printing, laser printing and copying devices, dot matrix type impact printers, thermal paper printers, film recorders, thermal wax printers, dye sublimation printers and ink jet printers both of the drop on demand and continuous flow type. Each type of printer has its own advantages and problems when considering cost, speed, quality, reliability, simplicity of construction and operation etc.

[0003] In recent years, the field of ink jet printing, wherein each individual pixel of ink is derived from one or more ink nozzles has become increasingly popular primarily due to its inexpensive and versatile nature.

[0004] Many different techniques on ink jet printing have been invented. For a survey of the field, reference is made to an article by J Moore, "Non-Impact Printing: Introduction and Historical Perspective", Output Hard Copy Devices, Editors R Dubeck and S Sherr, pages 207 - 220 (1988).

[0005] Ink Jet printers themselves come in many different types. The utilization of a continuous stream of ink in ink jet printing appears to date back to at least 1929 wherein US Patent No. 1941001 by Hansell discloses a simple form of continuous stream electro-static ink jet printing.

[0006] US Patent 3596275 by Sweet also discloses a process of a continuous ink jet printing including the step wherein the ink jet stream is modulated by a high frequency electro-static field so as to cause drop separation. This technique is still utilized by several manufacturers including Elmjett and Scitex (see also US Patent No. 3373437 by Sweet et al)

[0007] Piezoelectric ink jet printers are also one form of commonly utilized ink jet printing device. Piezoelectric systems are disclosed by Kyser et. al. in US Patent No. 3946398 (1970) which utilizes a diaphragm mode of operation, by Zolten in US Patent 3683212 (1970) which discloses a squeeze mode of operation of a piezoelectric crystal, Stemme in US Patent No. 3747120 (1972) discloses a bend mode of piezoelectric operation, Howkins in US Patent No. 4459601 discloses a piezoelectric push mode actuation of the ink jet stream and Fischbeck in US 4584590 which discloses a shear mode type of piezoelectric transducer element.

[0008] Recently, thermal ink jet printing has become an extremely popular form of ink jet printing. The ink jet printing techniques include those disclosed by Endo et al in GB 2007162 (1979) and Vaught et al in US Patent 4490728. Both the aforementioned references disclosed ink jet printing techniques that rely upon the activation of an electrothermal actuator which results in the creation of a bubble in a constricted space, such as a nozzle, which thereby causes the ejection of ink from an aperture connected to the confined space onto a relevant print media. Printing devices utilizing the electrothermal actuator are manufactured by manufacturers such as Canon and Hewlett Packard.

[0009] As can be seen from the foregoing, many different types of printing technologies are available. Ideally, a printing technology should have a number of desirable attributes. These include inexpensive construction and operation, high speed operation, safe and continuous long term operation etc. Each technology may have its own advantages and disadvantages in the areas of cost, speed, quality, reliability, power usage, simplicity of construction operation, durability and consumables.

[0010] The present Applicant has disclosed a plethora of pagewidth printhead designs. Stationary page with printheads, which extend across a width of a page, present a number of unique design challenges when compared with more conventional traversing inkjet printheads. For example, pagewidth printheads are typically built up from a plurality of individual printhead integrated circuits (ICs), which must be joined seamlessly to provide high print quality. The present Applicant has hitherto described printheads having a displaced section of nozzles, which enables nozzle rows to print seamlessly between abutting printhead integrated circuits spanning across a pagewidth (see US Patent Nos. 7,390,071 and 7,290,852). Other approaches to pagewidth printing (e. g. HP Edgeline™ Technology) employ staggered printhead modules, which inevitably increase the size of the print zone and place additional demands on media feed mechanisms in order to maintain proper alignment with the print zone. It would be desirable to provide an alternative nozzle design, which enables a new approach to the construction of pagewidth printheads.

[0011] Typically, pagewidth printheads include 'redundant' nozzle rows, which may be used for dead nozzle compensation or for modulating a peak power requirement of the printhead (see US Patent Nos. 7,465,017 and 7,252,353). Dead nozzle compensation is a particular problem in stationary pagewidth printheads, in contrast with traversing printheads, because the media substrate only makes a single pass of each nozzle in the printhead during printing. Redundancy inevitably increases the cost and complexity of pagewidth printheads, and it would be desirable to minimize redundant nozzle row(s) whilst still providing adequate mechanisms for dead nozzle compensation.

[0012] It would be further desirable to provide more versatile pagewidth printheads, which are able to control,

for example, drop placement and/or dot resolution.

[0013] It would be further desirable to provide printheads with alternative integration of MEMS and CMOS layers. It would be especially desirable to minimize the undesirable phenomenon of 'ground bounce' and thereby improve the overall electrical efficiency of printheads.

[0014] The document US 2004/104973 A1 discloses a fluid injection head structure which is formed on a substrate and has a manifold therein, bubble generators, a conductive trace, and at least two rows of chambers adjacent to the manifold in flow communication with the manifold. The conductive trace disposed on a top surface of the substrate and partially disposed between the two rows of the chambers above the manifold is used to drive the bubble generator.

Summary of the Invention

[0015] The present invention provides a printhead as defined in the accompanying claims. Advantageous features of the invention are disclosed in the dependent claims.

Brief Description of the Drawings

[0016] Optional embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a part of a printhead IC having conductive tracks disposed on a nozzle plate; Figure 2 is a simplified circuit diagram for an actuator connected to a drive pFET;

Figure 3 is a simplified circuit diagram for an actuator connected to a drive nFET; and

Figure 4 is a plan view of a part of an alternative printhead IC having conductive tracks disposed on a nozzle plate.

Description of Optional Embodiments

Improved MEMS/CMOS Integration

[0017] An important aspect of MEMS printhead design is the integration of MEMS actuators with underlying CMOS drive circuitry. In order for a nozzle actuation to occur, current from a drive transistor in the CMOS drive circuitry layer must flow up into the MEMS layer, through the actuator and back down to the CMOS drive circuitry layer (e.g. to a ground plane in the CMOS layer). With several thousand actuators in one printhead IC, the efficiency of current flow paths should be maximized so as to minimize losses in overall printhead efficiency.

[0018] Hitherto, the Applicant has described nozzle assemblies having a pair of linear posts extending between a MEMS actuator (positioned in the nozzle chamber roof) and an underlying CMOS drive circuitry layer. Linear copper posts extending up to the MEMS layer, as opposed

to more tortuous current pathways, have been shown to improve printhead efficiency. Nevertheless, there is still scope for improving the electrical efficiency of the Applicant's MEMS printheads (and printhead ICs).

[0019] One problem associated with controlling several thousand actuations from common CMOS power and ground planes is known as 'ground bounce'. Ground bounce is a well known problem in integrated circuit design, which is particularly exacerbated by having a large number of devices powered between common power and ground planes. Ground bounce usually describes an unwanted voltage drop across either a power or ground plane, which may arise from many different sources. Typical sources of ground bounce include: series resistance ("IR drop"), self-inductance, and mutual inductance between ground and power planes. Each of these phenomena may contribute to ground bounce by undesirably decreasing the potential difference between power and ground planes. This decreased potential difference inevitably results in reduced electrical efficiency of the integrated circuit, more particularly the printhead IC in the present case. It will be appreciated that the arrangement and configuration of power and ground planes, as well as connections thereto, can fundamentally affect ground bounce and the overall efficiency of a printhead.

[0020] Referring to Figure 1, there is shown in plan view part of a printhead IC 300 having conductive tracks extending longitudinally and parallel with nozzle rows. The uppermost polymer layer 19 has been removed for clarity in Figure 1.

[0021] A plurality of nozzles 210 are arranged in nozzle rows extending along a longitudinal axis of the printhead IC 300. Figure 1 shows a pair of nozzle rows 302A and 302B, although the printhead IC 300 may of course comprises more nozzle rows. The nozzle rows 302A and 302B are paired and offset from each other, with one nozzle row 302A being responsible for printing 'even' dots and the other nozzle row 302B being responsible for printing 'odd' dots.

[0022] A first conductive track 303 is positioned between the nozzle rows 302A and 302B. The first conductive track 303 is deposited on the nozzle plate 304 of the printhead IC 300, which defines the nozzle chamber roofs 7. Thus, the first conductive track 303 is generally coplanar with the thermoelastic beams 10 of the actuators 15 and may be formed during MEMS fabrication by co-deposition with the thermoelastic beam material (e.g. vanadium-aluminium alloy). Conductivity of the conductive track 303 may be further improved by deposition of another conductive metal layer (e.g. copper, titanium, aluminium etc) during MEMS fabrication. For example, it will be appreciated that a metal layer may be deposited prior to deposition of the thermoelastic beam material. Hence, the conductive track 303 may comprise multiple metal layers so as to optimize conductivity.

[0023] Each actuator 15 has a first terminal directly connected to the first conductive track 303 via a transverse connector 305. As will be seen in Figure 1, each

actuator from both nozzle rows 302A and 302B has a first terminal connected to the first conductive track 303. The first conductive track 303 is connected to a common reference plane in the underlying CMOS drive circuitry layer via a plurality of conductor posts 307. Thus, the conductive track 303 may extend continuously along the printhead IC 300 to provide a common reference plane for each actuator in the pair of nozzle rows. As will be discussed in more detail below, the common reference plane between the nozzle rows 302A and 302B may be a power plane or a ground plane, depending on whether nFETs or pFETs are employed in the CMOS drive circuitry.

[0024] Alternatively, the conductive track 303 may extend discontinuously along the printhead IC 300, with each portion of the conductive track providing a common reference plane for a set of actuators. A discontinuous conductive track 303 may be preferable in cases where delamination of the conductive track is problematic, although the conductive track still functions in the same manner as described above.

[0025] A second terminal of each actuator 15 is connected to an underlying drive FET in the CMOS drive circuitry layer via an actuator post 8 extending between the actuator and the CMOS drive circuitry layer. Thus, each actuator 15 is individually controlled by a respective drive FET.

[0026] In Figure 1, a pair of second conductive tracks 310A and 310B also extend longitudinally along the printhead IC 300 and flank the pair of nozzle rows 302A and 302B. The second conductive tracks 310A and 310B complement the first conductive track 303. In other words, if the first conductive track 303 is a power plane, then the second conductive tracks are both ground planes. Conversely, if the first conductive track 303 is a ground plane, then the second conductive tracks are both power planes. The second conductive tracks 310A and 310B are not directly connected to the actuators 15; however, they are connected to a corresponding reference plane (power or ground) in the CMOS drive circuitry layer via a plurality of conductor posts 307.

[0027] It will be appreciated that the second conductive tracks 310 may be formed during MEMS fabrication in an entirely analogous manner to the first conductive track 303, as described above. Accordingly, the second conductive tracks 310 are typically comprised of the thermoelastic beam material and may be multiple-layered so as to enhance conductivity.

[0028] The first and second conductive tracks 303 and 310 function primarily to reduce the series resistance of corresponding reference planes in the CMOS drive circuitry layer. Thus, by providing conductive tracks in the MEMS layer, which are electrically connected in parallel with corresponding reference planes in the CMOS layer, the overall resistance of these reference planes is significantly reduced by a simple application of Ohm's law. Generally, the conductive tracks are configured so as to minimize their resistance, for example by maximizing

their width or depth as far as possible.

[0029] The series resistance of a ground plane or a power plane may be reduced by at least 25%, at least 50%, at least 75% or at least 90% by virtue of the conductive tracks in the MEMS layer. Likewise, the self-inductance of a ground plane or a power plane may be similarly reduced. This significant reduction in series resistance and self-inductance of both ground and power planes helps to minimize ground bounce in the printhead IC 300 and therefore improves printhead efficiency. It is understood by the present inventors that mutual inductance between power and ground planes is also reduced in the printhead IC 300 shown in Figure 1, although quantitative analysis of mutual inductance requires complex modeling, which is beyond the scope of this disclosure.

[0030] Figures 2 and 3 provide simplified CMOS circuit diagrams for a pFET and a nFET drive transistor. The drive transistor (either nFET or pFET) is directly connected to the second terminal of each actuator 15 via the actuator post 8, as shown in Figure 1.

[0031] In Figure 2, the actuator 15 is connected between the drain of a pFET and the ground plane ("Vss"). The power plane ("Vpos") is connected to the source of the pFET, while the gate receives the logic fire signal. When the pFET receives a low voltage at the gate (by virtue of the NAND gate), current flows through the pFET so that the actuator 15 is actuated. In the pFET circuit, the first terminal of the actuator is connected to the ground plane provided by the first conductive track 303, while the second terminal of the actuator is connected to the pFET. Hence, the second conductive tracks provide power planes.

[0032] In Figure 3, the actuator 15 is connected between the power plane ("Vpos") and the source of a nFET. The ground plane ("Vss") is connected to the drain of the nFET, while the gate receives the logic fire signal. When the nFET receives a high voltage at the gate (by virtue of the AND gate), current flows through the nFET so that the actuator 15 is actuated. In the nFET circuit, the first terminal of the actuator is connected to the power plane provided by the first conductive track 303, while the second terminal of the actuator is connected to the nFET. Hence, the second conductive tracks provide ground planes.

[0033] From Figures 2 and 3, it will be appreciated that the first and second conductive tracks 303 and 310 are compatible with either pFETs or nFETs.

[0034] Of course, the advantages of using conductive tracks, as described above, are not in any way limited to the nozzles 210 shown in Figure 1. Any printhead IC with any type of actuator can, in principle, benefit from the conductive tracks described above.

[0035] Figure 4 shows a printhead IC 400 comprising a plurality of nozzles 100 arranged in a longitudinally extending pair of nozzle rows 302A and 302B. The first conductive track 303 extends between the pair of nozzle rows 302A and 302B, and the second conductive tracks

310A and 310B flank the pair of nozzle rows. Each actuator 15 of a respective nozzle 100 has a first terminal connected to the first conductive track 303 via a transverse connector 305, and a second terminal is connected to an underlying FET via an actuator post 8. It will therefore be appreciated that the printhead IC 400 functions analogously to the printhead IC 300 in the sense that the conductive tracks 303 and 310 provide common reference planes by virtue of connections to corresponding reference planes in underlying CMOS drive circuitry. Moreover, the first conductive track 303 is directly connected to one terminal of each actuator so as to provide a common reference plane for each actuator in both nozzle rows 302A and 302B.

[0036] It will be appreciated by ordinary workers in this field that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

Claims

1. An inkjet printhead (300) comprising:

a substrate comprising a CMOS drive circuitry layer;
a plurality of nozzle chambers (5) disposed on an upper surface of said substrate and arranged in one or more nozzle rows extending longitudinally along said printhead, each nozzle chamber having a floor defined by said upper surface and a MEMS actuator (15) for ejecting ink;
a nozzle plate (304) extending across said printhead, said nozzle plate forming a roof (7) of each nozzle chamber, each roof being spaced apart from the floor and each roof having a nozzle opening (13) formed therein; and
at least one conductive track (303) extending longitudinally along said printhead and parallel with said nozzle rows,

wherein:

said conductive track (303) is disposed on a surface of said nozzle plate (304) opposite the nozzle chamber (5); and
said conductive track (303) is electrically connected in parallel with a ground or power plane in said CMOS drive circuitry layer via a plurality of conductor posts (307) connected between the ground or power plane in said drive circuitry layer and the conductive track.

2. The inkjet printhead of claim 1 comprising at least one first conductive track, wherein said first conduc-

tive track is directly connected to a plurality of actuators in at least one nozzle row adjacent said first conductive track.

3. The inkjet printhead of claim 2 further comprising at least one second conductive track, wherein said second conductive track is not directly connected to any actuators.

4. The inkjet printhead of claim 2, wherein said first conductive track extends continuously along said printhead.

5. The inkjet printhead of claim 2, wherein said first conductive track extends discontinuously along said printhead.

6. The inkjet printhead of claim 2, wherein the first conductive track is positioned between a respective pair of nozzle rows.

7. The inkjet printhead of claim 2, wherein each actuator has a first terminal directly connected to said first conductive track and a second terminal connected to a drive transistor in the drive circuitry layer.

8. The inkjet printhead of claim 7, wherein each roof comprises at least one actuator and said first terminal of each actuator is connected to said first conductive track via transverse connectors extending transversely across said nozzle plate relative to said first conductive track.

9. The inkjet printhead of claim 8, wherein said second terminal is connected to said drive transistor via an actuator post extending between said drive circuitry layer and said second terminal.

10. The inkjet printhead of claim 9, wherein said actuator posts are perpendicular to a plane of the first conductive track.

11. The inkjet printhead of claim 8, wherein each roof includes at least one moveable paddle comprising a respective thermal bend actuator, said paddle being moveable towards the floor of a respective nozzle chamber so as to cause ejection of ink from said nozzle opening, wherein said thermal bend actuator comprises:

an upper thermoelastic beam having said first and second terminals; and
a lower passive beam fused to said thermoelastic beam, such that when a current is passed through the thermoelastic beam, the thermoelastic beam expands relative to the passive beam, resulting in bending of a respective paddle towards the floor of the nozzle chamber.

12. The inkjet printhead of claim 11, wherein said thermoelastic beam is coplanar with said conductive track.
13. The inkjet printhead of claim 11, wherein said thermoelastic beam and said conductive track are comprised of a same material.
14. The inkjet printhead of claim 1, wherein said nozzle plate is comprised of a ceramic material.

Patentansprüche

1. Tintenstrahldruckkopf (300), umfassend:

ein Substrat, das eine CMOS-Treiberschaltungsschicht umfasst;
eine Vielzahl von Düsenkammern (5), die auf einer oberen Oberfläche des Substrats angeordnet sind und in einer oder mehreren Düsenreihen eingerichtet sind, die sich in Längsrichtung entlang des Druckkopfes erstrecken, wobei jede Düsenkammer ein Unterteil, das durch die obere Oberfläche definiert ist, und ein MEMS-Stellglied (15) zum Ausstoßen von Tinte aufweist;
eine Düsenplatte (304), die sich über den Druckkopf erstreckt, wobei die Düsenplatte ein Oberteil (7) jeder Düsenkammer bildet, wobei jedes Oberteil von dem Unterteil beabstandet ist und in jedem Oberteil eine Düsenöffnung (13) gebildet ist; und
mindestens eine Leiterbahn (303), die sich in Längsrichtung entlang des Druckkopfes und parallel zu den Düsenreihen erstreckt,

wobei:

die Leiterbahn (303) auf einer Oberfläche der Düsenplatte (304) gegenüber der Düsenkammer (5) angeordnet ist; und
die Leiterbahn (303) mit einer Masse- oder Energieebene in der CMOS-Treiberschaltungsschicht über eine Vielzahl von Leiterstützstiften (307), die zwischen der Masse- oder Energieebene in der Treiberschaltungsschicht und der Leiterbahn verbunden sind, elektrisch parallel geschaltet ist.

2. Tintenstrahldruckkopf nach Anspruch 1, umfassend mindestens eine erste Leiterbahn, wobei die erste Leiterbahn mit einer Vielzahl von Stellgliedern in mindestens einer Düsenreihe, die an die erste Leiterbahn angrenzt, direkt verbunden ist.
3. Tintenstrahldruckkopf nach Anspruch 2, ferner umfassend mindestens eine zweite Leiterbahn, wobei

die zweite Leiterbahn nicht direkt mit einem Stellglied verbunden ist.

4. Tintenstrahldruckkopf nach Anspruch 2, wobei sich die erste Leiterbahn durchgehend entlang des Druckkopfes erstreckt.
5. Tintenstrahldruckkopf nach Anspruch 2, wobei sich die erste Leiterbahn nicht durchgehend entlang des Druckkopfes erstreckt.
6. Tintenstrahldruckkopf nach Anspruch 2, wobei die erste Leiterbahn zwischen einem jeweiligen Paar von Düsenreihen positioniert ist.
7. Tintenstrahldruckkopf nach Anspruch 2, wobei jedes Stellglied eine erste Klemme, die mit der ersten Leiterbahn direkt verbunden ist, und eine zweite Klemme, die mit einem Treibertransistor in der Treiberschaltungsschicht verbunden ist, aufweist.
8. Tintenstrahldruckkopf nach Anspruch 7, wobei jedes Oberteil mindestens ein Stellglied umfasst, und die erste Klemme jedes Stellglieds mit der ersten Leiterbahn über Querverbindungsstücke verbunden ist, die sich im Verhältnis zu der ersten Leiterbahn quer über die Düsenplatte erstrecken.
9. Tintenstrahldruckkopf nach Anspruch 8, wobei die zweite Klemme mit dem Treibertransistor über einen Stellgliedstützstift verbunden ist, der sich zwischen der Treiberschaltungsschicht und der zweiten Klemme erstreckt.
10. Tintenstrahldruckkopf nach Anspruch 9, wobei die Stellgliedstützstifte rechtwinklig zu einer Ebene der ersten Leiterbahn sind.
11. Tintenstrahldruckkopf nach Anspruch 8, wobei jedes Oberteile mindestens einen bewegbaren Flügel umfasst, der ein jeweiliges thermisches Biegestellglied umfasst, wobei der Flügel in Richtung auf das Unterteil einer jeweiligen Düsenkammer bewegbar ist, um das Ausstoßen von Tinte aus der Düsenöffnung zu bewirken, wobei das thermische Biegestellglied Folgendes umfasst:

einen oberen thermoelastischen Träger, der erste und zweite Klemmen aufweist; und
einen unteren passiven Träger, der mit dem thermoelastischen Träger verschmolzen ist, so dass sich, wenn Strom durch den thermoelastischen Träger gegeben wird, der thermoelastische Träger im Verhältnis zu dem passiven Träger ausdehnt, was zu einer Biegung eines jeweiligen Flügels in Richtung auf das Unterteil der Düsenkammer führt.

12. Tintenstrahldruckkopf nach Anspruch 11, wobei der thermoelastische Träger zu der Leiterbahn koplanar ist.
13. Tintenstrahldruckkopf nach Anspruch 11, wobei der thermoelastische Träger und die Leiterbahn aus dem gleichen Material bestehen.
14. Tintenstrahldruckkopf nach Anspruch 1, wobei die Düsenplatte aus einem Keramikmaterial besteht.

Revendications

1. Tête d'impression à jet d'encre (300) comprenant :
- un substrat comprenant une couche de circuiterie d'excitation CMOS ;
 - une pluralité de chambres de buse (5) disposées sur une surface supérieure dudit substrat et agencée dans une ou plusieurs rangées de buses s'étendant longitudinalement le long de ladite tête d'impression, chaque chambre de buse ayant un plancher défini par ladite surface supérieure et un actionneur MEMS (15) pour éjecter de l'encre ;
 - une plaque à buses (304) s'étendant à travers ladite tête d'impression, ladite plaque à buses formant un plafond (7) de chaque chambre de buse, chaque plafond étant espacé du plancher et chaque plafond ayant une ouverture de buse (13) formée dans celui-ci ; et
 - au moins une piste conductrice (303) s'étendant longitudinalement le long de ladite tête d'impression et parallèlement auxdites rangées de buses,
- dans laquelle :
- ladite piste conductrice (303) est disposée sur une surface de ladite plaque à buses (304) opposée à la chambre de buse (5) ; et
 - ladite piste conductrice (303) est reliée électriquement en parallèle avec un plan de masse ou d'alimentation dans ladite couche de circuiterie d'excitation CMOS par l'intermédiaire d'une pluralité de broches conductrices (307) reliées entre le plan de masse ou d'alimentation dans ladite couche de circuiterie d'excitation et la piste conductrice.
2. Tête d'impression à jet d'encre selon la revendication 1, comprenant au moins une première piste conductrice, ladite première piste conductrice étant reliée directement à une pluralité d'actionneurs dans au moins une rangée de buses adjacente à ladite première piste conductrice.

3. Tête d'impression à jet d'encre selon la revendication 2, comprenant en outre au moins une seconde piste conductrice, ladite seconde piste conductrice n'étant pas reliée directement aux actionneurs.
4. Tête d'impression à jet d'encre selon la revendication 2, dans laquelle ladite première piste conductrice s'étend de manière continue le long de ladite tête d'impression.
5. Tête d'impression à jet d'encre selon la revendication 2, dans laquelle ladite première piste conductrice s'étend de manière discontinue le long de ladite tête d'impression.
6. Tête d'impression à jet d'encre selon la revendication 2, dans laquelle la première piste conductrice est positionnée entre une paire respective de rangées de buses.
7. Tête d'impression à jet d'encre selon la revendication 2, dans laquelle chaque actionneur a une première borne reliée directement à ladite première piste conductrice et une seconde borne reliée à un transistor d'excitation dans la couche de circuiterie d'excitation.
8. Tête d'impression à jet d'encre selon la revendication 7, dans laquelle chaque plafond comprend au moins un actionneur et ladite première borne de chaque actionneur est reliée à ladite première piste conductrice par l'intermédiaire de connecteurs transversaux s'étendant transversalement à travers ladite plaque à buses par rapport à ladite première piste conductrice.
9. Tête d'impression à jet d'encre selon la revendication 8, dans laquelle ladite seconde borne est reliée audit transistor d'excitation par l'intermédiaire d'une broche d'actionneur s'étendant entre ladite couche de circuiterie d'excitation et ladite seconde borne.
10. Tête d'impression à jet d'encre selon la revendication 9, dans laquelle lesdites broches d'actionneur sont perpendiculaires à un plan de la première piste conductrice.
11. Tête d'impression à jet d'encre selon la revendication 8, dans laquelle chaque plafond comprend au moins une pale mobile comprenant un actionneur à flexion thermique respectif, ladite pale étant mobile vers le plancher d'une chambre de buse respective de façon à entraîner l'éjection d'encre à partir de ladite ouverture de buse, ledit actionneur à flexion thermique comprenant :
- une poutre thermo-élastique supérieure ayant lesdites première et seconde bornes ; et

une poutre passive inférieure fusionnée avec ladite poutre thermo-élastique, de telle sorte que lorsqu'un courant est amené à passer à travers la poutre thermo-élastique, la poutre thermo-élastique s'agrandit par rapport à la poutre passive, entraînant la flexion d'une pale respective vers le plancher de la chambre de buse.

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12. Tête d'impression à jet d'encre selon la revendication 11, dans laquelle ladite poutre thermo-élastique est coplanaire avec ladite piste conductrice.

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13. Tête d'impression à jet d'encre selon la revendication 11, dans laquelle ladite poutre thermo-élastique et ladite piste conductrice sont faites d'un même matériau.

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14. Tête d'impression à jet d'encre selon la revendication 1, dans laquelle ladite plaque à buses est faite d'un matériau céramique.

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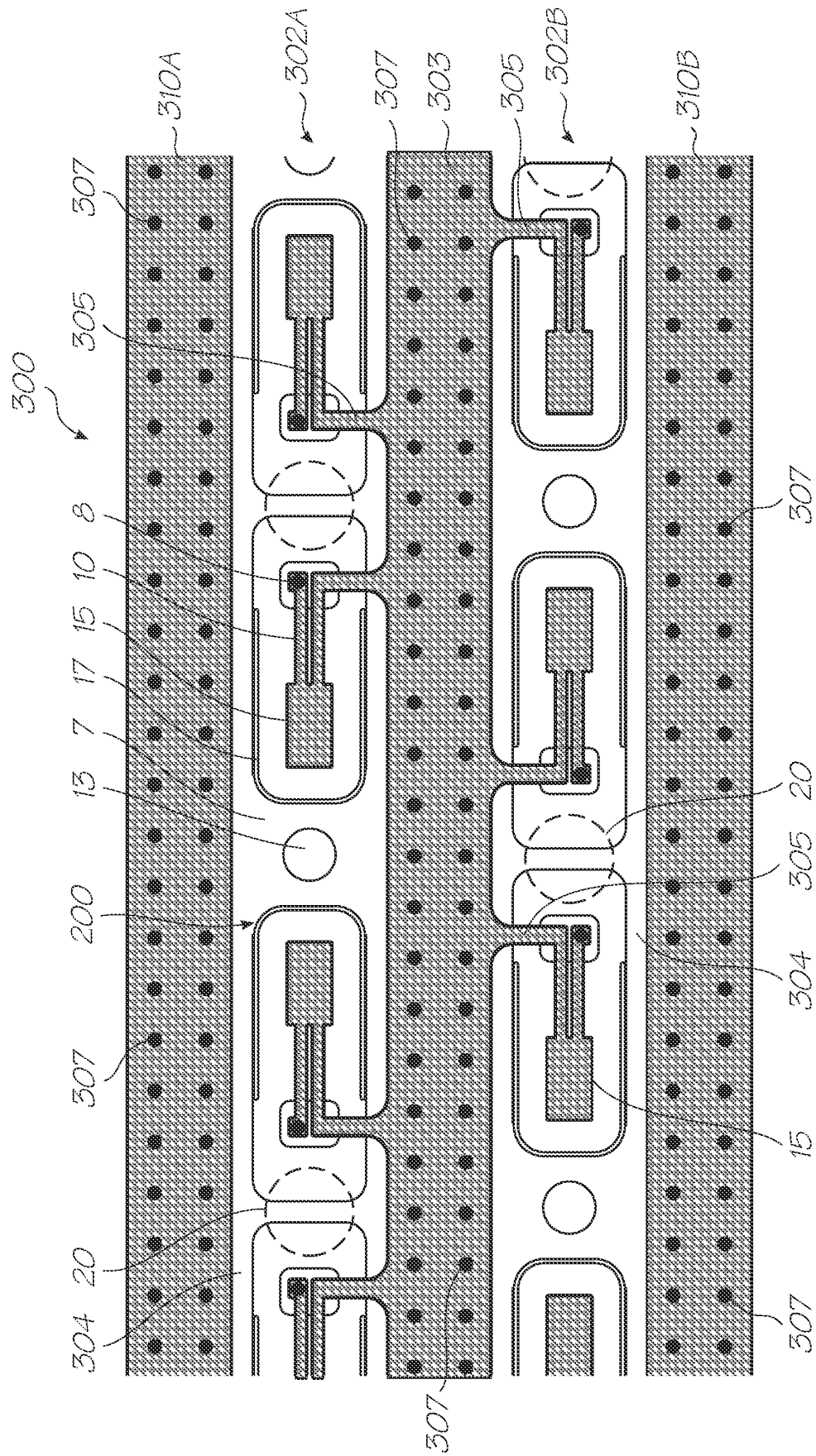


FIG. 1

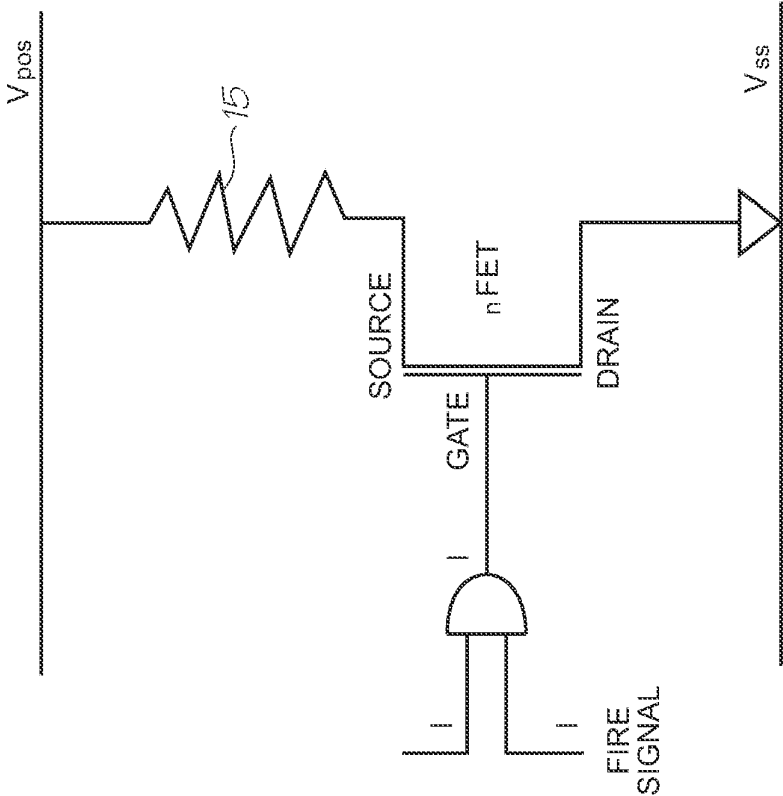


FIG. 3

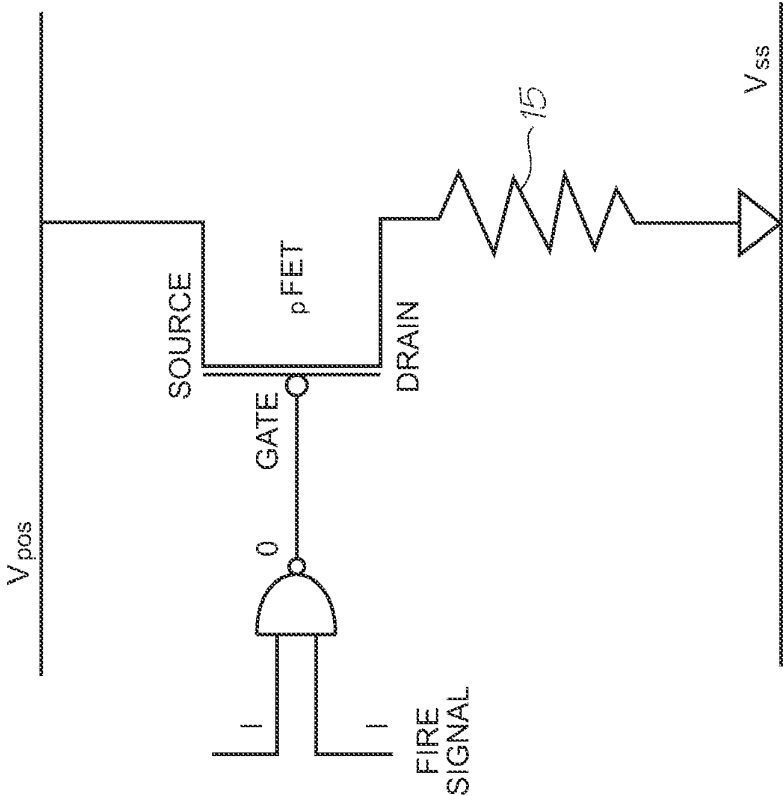


FIG. 2

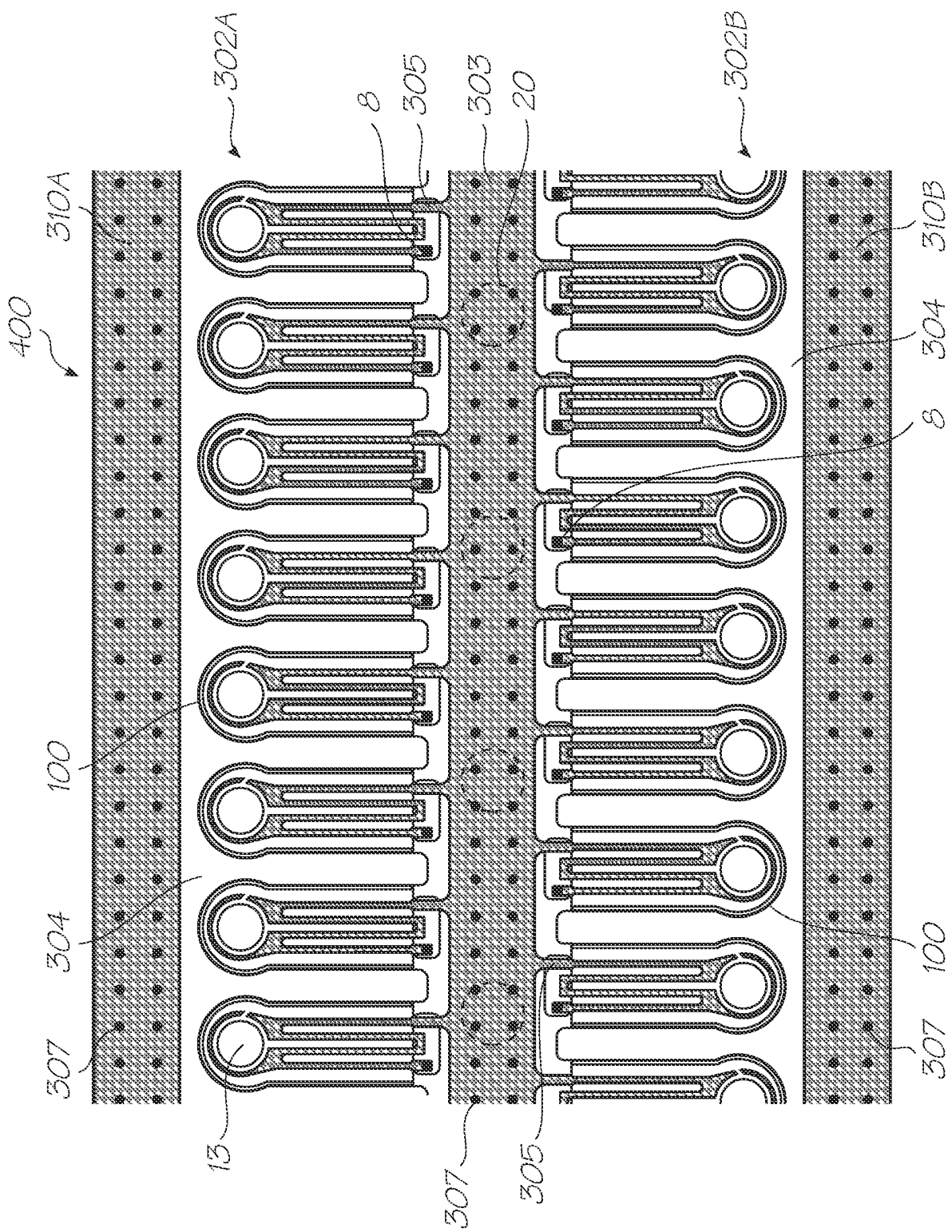


FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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