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(54) **PRINTHEAD CARTRIDGE WITH TWO FLUID COUPLINGS**

DRUCKKOPFPATRONE MIT ZWEI STRÖMUNGSKUPPLUNGEN

TÊTE D'IMPRESSION EN CARTOUCHE À DEUX COUPLAGES FLUIDES

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(73) Proprietor: **Silverbrook Research Pty. Ltd**
Balmain, New South Wales 2041 (AU)

(72) Inventors:
• **HIBBARD, Christopher**
Balmain, NSW 2041 (AU)
• **DYER, Geoffrey, Philip**
Balmain, NSW 2041 (AU)
• **MACKEY, Paul, Ian**
Balmain, NSW 2041 (AU)
• **TSUBONO, Makomo**
Balmain, NSW 2041 (AU)
• **BERTOK, Attila**
Balmain, NSW 2041 (AU)
• **SILVERBROOK, Kia**
Balmain, NSW 2041 (AU)
• **ABRAHAM, Nicholas, Kenneth**
Balmain, NSW 2041 (AU)

- **NAKAZAWA, Akira**
Balmain, NSW 2041 (AU)
- **BERRY, Norman, Michael**
Balmain, NSW 2041 (AU)
- **JACKSON, Garry, Raymond**
Balmain, NSW 2041 (AU)
- **KARPPINEN, Vesa**
Balmain, NSW 2041 (AU)
- **GRAF, Andrew, John**
Balmain, NSW 2041 (AU)
- **MORGAN, John, Douglas**
Balmain, NSW 2041 (AU)
- **MCAULIFFE, Patrick, John**
Balmain, NSW 2041 (AU)

(74) Representative: **Keane, Paul Fachtna et al**
Hanna, Moore & Curley
13 Lower Lad Lane
2 Dublin (IE)

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to be field of printers and in particular pagewidth inkjet printers.

BACKGROUND OF THE INVENTION

[0002] The Applicant has developed a wide range of printers that employ pagewidth printheads instead of traditional reciprocating printhead designs. Pagewidth designs increase print speeds as the printhead does not traverse back and forth across the page to deposit a line of an image. The pagewidth printhead simply deposits the ink on the media as it moves past at high speeds. Such printheads have made it possible to perform full colour 1600dpi printing at speeds in the vicinity of 60 pages per minute, speeds previously unattainable with conventional inkjet printers.

[0003] The high print speeds require a large ink supply flow rate. Not only are the flow rates higher but distributing the ink along the entire length of a pagewidth printhead is more complex than feeding ink to a relatively small reciprocating printhead. To address the many issues associated with supplying ink to a pagewidth printhead, the applicant has developed an active fluidic system which gives the user control of the ink flow through the printhead. The active fluidic system is described in detail in the applicant scope pending application USSN 11/872718, the contents of which is incorporated herein by cross-reference. The active fluidic system connects the pagewidth printhead to an ink supply reservoir via a pump or pressure pulse generator. The pagewidth printhead is also connected to a waste ink outlet or sump. While the active fluidic system can correct problems such as nozzle deprime, air bubbles, nozzle face floods and de-cap clogging, it will not fix "dead" nozzles that simply bum out or otherwise fail over the life of the printhead.

[0004] WO 98/19864 discloses a replaceable printhead cartridge for an ink jet printer comprising a pagewidth printhead.

SUMMARY OF THE INVENTION

[0005] Accordingly the present invention provides a printhead cartridge according to claim 1.

[0006] This recognizes that individual ink ejection nozzles may fail over time and eventually there are enough dead nozzles to cause artifacts in the printed image. Providing pagewidth printhead is a user removable cartridge allows the user to periodically replace the printhead and hence maintain the print quality without replacing the entire printer.

[0007] The first fluid coupling has an interface plate supporting a plurality of spouts positioned for sealed engagement with corresponding apertures in a complementary socket on the printer in order to establish fluid

communication with a corresponding plurality of ink tanks containing different types of ink such that each of the plurality of spouts is supplied with one of the different types of ink respectively. In a further preferred form the interface plate has surface formations individually associated with each of the spouts respectively, the surface formations defining preferred flow path along the interface plate for any residual ink draining away from the spouts under gravity, the preferred flow paths being configured to avoid any other spouts. In particular preferred forms, the surface formations are the grooves in the interface plate. In a further preferred form, the spouts are arranged in a circular formation on the interface plate. Preferably, the grooves extend in a generally vertical direction when the printhead cartridge is oriented as will be when installed, the grooves deviating from generally vertical to avoid one of the spouts of a different ink type.

[0008] Preferably, each of the spouts have an end formation configured to engage the shut off valve in the complementary socket on the printer, the end formation being configured to open the shut off valve upon installation of the printhead cartridge in the printer. In a particularly preferred form, each of the spouts have at least one aperture in a side wall for establishing fluid communication with the pagewidth printhead.

[0009] The cartridge body has an elongate structure with a plurality of longitudinally extending channels, each of the longitudinally extending channels being for one of the different types of ink supply to the printhead by the respective spouts of the first fluid coupling. In particular preferred form, the pagewidth printhead has a plurality of printhead ICs mounted to the elongate structure such that the printhead ICs are aligned with each other and the longitudinal extent of the longitudinally extending channels. Optionally, the elongate structure has a series of fine conduits extending from each of the longitudinally extending channels to the printhead ICs.

[0010] In particular preferred form, the second fluid coupling is structurally under an image of the first fluid coupling. The first fluid coupling is positioned at one end of the elongate structure and the second fluid coupling is positioned at the opposite end of the elongate structure such that the spouts of the first and second fluid couplings are in fluid communication with the respective ends of the corresponding longitudinally extending channels.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Preferred embodiments of the invention will now be described by way of example only, with reference to the accompanying figures, in which:

Figure 1 is schematic overview of the printer fluidic system;

Figure 2A is a perspective of the printhead cartridge of the present invention installed the print engine of a printer;

Figure 2B shows the print engine without the print-

head cartridge installed to expose the inlet and outlet ink couplings;

Figure 3 is a perspective of the complete printhead cartridge according to the present invention;

Figure 4 shows the printhead cartridge of Fig. 3 with the protective cover removed;

Figure 5 is an exploded is a partial perspective of the printhead assembly within the printhead cartridge of Fig. 3;

Figure 6 is an exploded perspective of the printhead assembly without the inlet or outlet manifolds or the top cover molding;

Figure 7 is a sectional perspective view of the print engine, the section taken through the line 7-7 of Figure 2A;

Figure 8 is a sectional elevation of the print engine taken through line 7-7 of Figure 2A, showing the maintenance carousel drawing the wiper blades over the doctor blade;

Figure 9 is a section view showing the maintenance carousel after drawing the wiper blades over the absorbent cleaning pad;

Figure 10 is a sectional view showing the maintenance carousel being lifted to cap the printhead with the capper maintenance station;

Figure 11 is a sectional view showing the maintenance carousel being lowered in order to uncap the printhead;

Figure 12 is a sectional view showing the wiper blades wiping the nozzle face of the printhead;

Figure 13 is a sectional view showing the maintenance carousel rotated back to its initial position shown in Figure 8 where the wiper blades have been drawn past the doctor blade to flick contaminants of the tip region;

Figure 14 is a sectional view showing the wiper blades been drawn across the absorbent cleaning pad;

Figure 15 is a sectional view showing the maintenance carousel rotated to present the printhead capper to the printhead;

Figure 16 is a sectional view showing the maintenance carousel being lifted to present the print platen to the printhead;

Figure 17 is a sectional view showing the way that is carousel being lifted to seal the printhead ICs with the capper;

Figure 18 is a perspective view of the maintenance carousel in isolation;

Figure 19 is another perspective view of the maintenance carousel in isolation in showing the carousel drive spur gear;

Figure 20 is an exploded perspective of the maintenance carousel in isolation;

Figure 21 is a cross-sectional through an intermediate point along the carousel length;

Figure 22 is a schematic section view of a second embodiment of the maintenance carousel, the main-

tenance carousel presenting a print platen to the printhead;

Figure 23 is a schematic section view of the second embodiment of the maintenance carousel with the printhead priming station engaging the printhead;

Figure 24 is a schematic section view of the second embodiment of the maintenance carousel with the wiper blades engaging the printhead;

Figure 25 is a schematic section view of the second embodiment of the maintenance carousel with an ink spittoon presented to the printhead;

Figure 26 is a schematic section view of the second time of maintenance carousel with the print platen presented to the printhead as the wiper blades are cleaned on the absorbent pad;

Figure 27 is a section view of the injection moulded core used in the second embodiment of the maintenance carousel;

Figure 28 is a schematic view of the injection moulding forms being removed from the core of the second embodiment of maintenance carousel;

Figure 29 is a section view of the print platen maintenance station shown in isolation;

Figure 30 is a section view of the printhead capper maintenance station shown in isolation;

Figure 31 is a section view of the wiper blade maintenance station shown in isolation;

Figure 32 is a section view of the printhead priming station shown in isolation;

Figure 33 is a section view of a blotting station shown in isolation;

Figure 34 is a schematic section view of a third embodiment of the maintenance carousel;

Figure 35 is a sketch of a first embodiment of the wiper member;

Figure 36 is a sketch of a second embodiment of the wiper member;

Figure 37 is a sketch of a third embodiment of the wiper member;

Figure 38 is a sketch of the fourth moment of the wiper member;

Figure 39 is a sketch of the fifth embodiment of the wiper member;

Figure 40 is a sketch of the sixth embodiment of the wiper member;

Figure 41 is a sketch of the seventh embodiment of the wiper member;

Figure 42 is a sketch of the eighth embodiment of the wiper member;

Figures 43A and 43B sketches of a nine embodiment of the wiper member;

Figure 44 is a sketch of a 10th embodiment of the wiper member;

Figure 45 is sketch of an 11th embodiment of the wiper member;

Figure 46 is sketch of a 12 embodiment of the wiper member;

Figure 47 is the sectional perspective of the print

engine without the printhead cartridge for the maintenance carousel;

Figure 48 is a perspective showing the independent drive assemblies used by the print engine;

Figure 49 is an exploded perspective of the independent drive assemblies shown in Figure 48; and, Figure 50 is an enlarged view of the left end of the exploded perspective showing in Figure 49.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Printer Fluidic System

[0012] Figure 1 is a schematic overview of the fluidic system used by the print engine described in Figures 2A and 2B. As previously discussed, the print engine has the key mechanical structures of an inkjet printer. The peripheral structures such as the outer casing, the paperfeed tray, paper collection tray and so on are configured to suit the specific printing requirements of the printer (for example, the photo printer, the network printer or Soho printer). The Applicant's photo printer disclosed in the co-pending application USSN 11/688863, is an example of an inkjet printer using a fluidic system according to Figure 1. The contents of this disclosure are incorporated herein by reference. The operation of the system and its individual components are described in detail in USSN 11/872719 the contents of which are incorporated herein by reference.

[0013] Briefly, the printer fluidic system has a printhead assembly 2 supplied with ink from an ink tank 4 via an upstream ink line 8. Waste ink is drained to a sump 18 via a downstream ink line 16. A single ink line is shown for simplicity. In reality, the printhead has multiple ink lines for full colour printing. The upstream ink line 8 has a shut off valve 10 for selectively isolating the printhead assembly 2 from the pump 12 and or the ink tank 4. The pump 12 is used to actively prime or flood the printhead assembly 2. The pump 12 is also used to establish a negative pressure in the ink tank 4. During printing, the negative pressure is maintained by the bubble point regulator 6.

[0014] The printhead assembly 2 is an LCP (liquid crystal polymer) molding 20 supporting a series of printhead ICs 30 secured with an adhesive die attach film (not shown). The printhead ICs 30 have an array of ink ejection nozzles for ejecting drops of ink onto the passing media substrate 22. The nozzles are MEMS (micro electro-mechanical) structures printing at true 1600 dpi resolution (that is, a nozzle pitch of 1600 npi), or greater. The fabrication and structure of suitable printhead IC's 30 are described in detail in USSN 11/246687, the contents of which are incorporated by reference. The LCP molding 20 has a main channel 24 extending between the inlet 36 and the outlet 38. The main channel 24 feeds a series of fine channels 28 extending to the underside of the LCP molding 20. The fine channels 28 supply ink

to the printhead ICs 30 through laser ablated holes in the die attach film.

[0015] Above the main channel 24 is a series of non-priming air cavities 26. These cavities 26 are designed to trap a pocket of air during printhead priming. The air pockets give the system some compliance to absorb and damp pressure spikes or hydraulic shocks in the ink. The printers are high speed pagewidth printers with a large number of nozzles firing rapidly. This consumes ink at a fast rate and suddenly ending a print job, or even just the end of a page, means that a column of ink moving towards (and through) the printhead assembly 2 must be brought to rest almost instantaneously. Without the compliance provided by the air cavities 26, the momentum of the ink would flood the nozzles in the printhead ICs 30. Furthermore, the subsequent 'reflected wave' can generate a negative pressure strong enough to deprime the nozzles.

Print Engine

[0016] Figure 2A shows a print engine 3 of the type that uses a print cartridge 2. The print engine 3 is the internal structure of an inkjet printer and therefore does not include any external casing, ink tanks or media feed and collection trays. The printhead cartridge 2 is inserted and removed by the user lifting and lowering the latch 126. The print engine 3 forms an electrical connection with contacts on the printhead cartridge 2 and a fluid coupling is formed via the sockets 120 and the inlet and outlet manifolds, 48 and 50 respectively.

[0017] Sheets of media are fed through the print engine by the main drive roller 186 and the exit feed roller 178. The main drive roller 186 is driven by the main drive pulley and encoder disk 188. The exit feed roller 178 is driven by the exit drive pulley 180 which is synchronized to the main drive pulley 188 by the media feed belt 182. The main drive pulley 188 is powered by the media feed motor 190 via the input drive belt 192.

[0018] The main drive pulley 188 has an encoder disk which is read by the drive pulley sensor 184. Data relating to the speed and number of revolutions of the drive shafts 186 and 178 is sent to the print engine controller (or PEC). The PEC (not shown) is mounted to the main PCB 194 (printed circuit board) and is the primary micro-processor for controlling the operation of the printer.

[0019] Figure 2B shows the print engine 3 with the printhead cartridge removed to reveal the apertures 122 in each of the sockets 120. Each aperture 122 receives one of the spouts 52 (see Figure 5) on the inlet and outlet manifolds. As discussed above, the ink tanks have an arbitrary position and configuration but simply connect to hollow spigots 124 (see Figure 8) at the rear of the sockets 120 in the inlet coupling. The spigot 124 at the rear of the outlet coupling leads to the waste ink outlet in the sump 18 (see Figure 1).

[0020] Reinforced bearing surfaces 128 are fixed to the pressed metal casing 196 of the print engine 3. These provide reference points for locating the printhead car-

tridge within the print engine. They are also positioned to provide a bearing surface directly opposite the compressive loads acting on the cartridge 2 when installed. The fluid couplings 120 push against the inlet and outlet manifolds of the cartridge when the manifold spouts (described below) open the shut off valves in the print engine (also described below). The pressure of the latch 126 on the cartridge 2 is also directly opposed by a bearing surface 128. Positioning the bearing surfaces 128 directly opposite the compressive loads in the cartridge 2, the flex and deformation in the cartridge is reduced. Ultimately, this assists the precise location of the nozzles relative to the media feed path. It also protects the less robust structures within the cartridge from damage.

Printhead Cartridge

[0021] Figure 3 is a perspective of the complete printhead cartridge 2. The printhead cartridge 2 has a top molding 44 and a removable protective cover 42. The top molding 44 has a central web for structural stiffness and to provide textured grip surfaces 58 for manipulating the cartridge during insertion and removal. The base portion of the protective cover 42 protects the printhead ICs (not shown) and line of contacts (not shown) prior to installation in the printer. Caps 56 are integrally formed with the base portion and cover the ink inlets and outlets (see 54 and 52 of Fig. 5).

[0022] Figure 4 shows the printhead assembly 2 with its protective cover 42 removed to expose the printhead ICs on the bottom surface and the line of contacts 33 on the side surface. The protective cover is discarded to the recycling waste or fitted to the printhead cartridge being replaced to contain leakage from residual ink. Figure 5 is a partially exploded perspective of the printhead assembly 2. The top cover 44 has been removed reveal the inlet manifold 48 and the outlet manifold 50. The inlet and outlet shrouds 46 and 47 have been removed to better expose the five inlet and outlet spouts (52 and 54). The inlet and outlet manifolds 48 and 50 form a fluid connection between each of the individual inlets and outlets and the corresponding main channel (see 24 in Figure 6) in the LCP molding. The main channel extends the length of the LCP molding and it feeds a series of fine channels on the underside of the LCP molding. A line of air cavities 26 are formed above each of the main channels 24. As explained above in relation to Figure 1, any shock waves or pressure pulses in the ink are damped by compressing the air the air cavities 26.

[0023] Figure 6 is an exploded perspective of the printhead assembly without the inlet or outlet manifolds or the top cover molding. The main channels 24 for each ink color and their associated air cavities 26 are formed in the channel molding 68 and the cavity molding 72 respectively. Adhered to the bottom of the channel molding 68 is a die attach film 66. The die attach film 66 mounts the printhead ICs 30 to the channel molding such that the fine channels on the underside of the channel molding

68 are in fluid communication with the printhead ICs 30 via small laser ablated holes through the film.

[0024] Both the channel molding 68 and the top cover molding 72 are molded from LCP (liquid crystal polymer) because of its stiffness and coefficient of thermal expansion that closely matches that of silicon. It will be appreciated that a relatively long structure such as a pagewidth printhead should minimize any thermal expansion differences between the silicon substrate of the printhead ICs 30 and their supporting structure.

Printhead Maintenance Carousel

[0025] Referring to Figure 7, a sectioned perspective view is shown. The section is taken through line 7-7 shown in Figure 2A. The printhead cartridge 2 is inserted in the print engine 3 such that its outlet manifold 50 is open to fluid communication with the spigot 124 which leads to a sump in the completed printer (typically situated at the base the print engine). The LCP molding 20 supports the printhead ICs 30 immediately adjacent the media feed path 22 extending through the print engine.

[0026] On the opposite side of the media feed path 22 is the printhead maintenance carousel 150 and its associated drive mechanisms. The printhead maintenance carousel 150 is mounted for rotation about the tubular drive shaft 156. The maintenance carousel 150 is also configured for movement towards and away from the printhead ICs 30. By raising the carousel 150 towards the printhead ICs 30, the various printhead maintenance stations on the exterior of the carousel are presented to the printhead. The maintenance carousel 150 is rotatably mounted on a lift structure 170 that is mounted to a lift structure shaft 156 such that it can pivot relative to the remainder of the print engine 3. The lift structure 170 includes a pair of lift arms 158 (only one lift arm is shown, the other being positioned at the opposite end of the lift structure shaft 156). Each lift arm 158 has a cam engaging surface 168, such as a roller or pad of low friction material. The cams (described in more detail below) are fixed to the carousel drive shaft 160 for rotation therewith. The lift arms 158 are biased into engagement with the cams on the carousel lift drive shaft 160, such that the carousel lift motor (described below) can move the carousel towards and away from the printhead by rotating the shaft 160.

[0027] The rotation of the maintenance carousel 150 about the tubular shaft 166 is independent of the carousel lift drive. The carousel drive shaft 166 engages the carousel rotation motor (described below) such that it can be rotated regardless of whether it is retracted from, or advanced towards, the printhead. When the carousel is advanced towards the printhead, the wiper blades 162 move through the media feed path 22 in order to wipe the printhead ICs 30. When retracted from the printhead, the carousel 150 can be repeatedly rotated such that the wiper blades 162 engage the doctor blade 154 and the cleaning pad 152. This is also discussed in more detail

below.

[0028] Referring now to Figure 8, the cross section 7-7 is shown in elevation to better depict the maintenance carousel lift drive. The carousel lift drive shaft 160 is shown rotated such that the lift cam 172 has pushed the lift arms 158 downwards via the cam engaging surface 168. The lift shaft 160 is driven by the carousel lift spur gear 174 which is in turn driven by the carousel lift worm gear 176. The worm gear 176 is keyed to the output shaft of the carousel lift motor (described below).

[0029] With the lift arms 158 drawing the lift structure 170 downwards, the maintenance carousel 150 is retracted away from the printhead ICs 30. In this position, the carousel 150 can be rotated with none of the maintenance stations touching the printhead ICs 30. It does, however, bring the wiper blades 162 into contact with the doctor blade 154 and the absorbent cleaning pad 152.

Doctor Blade

[0030] The doctor blade 154 works in combination with the cleaning pad 152 to comprehensively clean the wiper blades 162. The cleaning pad 152 wipes paper dust and dried ink from the wiping contact face of the wiper blades 162. However, a bead of ink and other contaminants can form at the tip of the blades 162 where it does not contact the surface of the cleaning pad 152.

[0031] To dislodge this ink and dust, the doctor blade 154 is mounted in the print engine 3 to contact the blades 162 after they have wiped the printhead ICs 30, but before they contact the cleaning pad 152. Upon contact with the doctor blade 154, the wiper blades 162 flex into a curved shape in order to pass. As the wiper blades 162 are an elastomeric material, they spring back to their quiescent straight shape as soon as they disengage from the doctor blade 154. Rapidly springing back to their quiescent shape projects dust and other contaminants from the wiper blade 162, and in particular, from the tip.

[0032] The ordinary worker will appreciate that the wiper blades 162 also flex when they contact the cleaning pad 152, and likewise spring back to their quiescent shapes once disengaged from the pad. However, the doctor blade 154 is mounted radially closer to the central shaft 166 of the carousel 150 than the cleaning pad 152. This bends the wiper blades 162 more as they pass, and so imparts more momentum to the contaminants when springing back to the quiescent shape. It is not possible to simply move the cleaning pad 152 closer to the carousel shaft 166 to bend the wiper blades 162 more, as the trailing blades would not properly wipe across the cleaning pad 152 because of contact with the leading blades.

Cleaning Pad

[0033] The cleaning pad 152 is an absorbent foam body formed into a curved shape corresponding to the circular path of the wiper blades 162. The pad 152 cleans

more effectively when covered with a woven material to provide a multitude of densely packed contacts points when wiping the blades. Accordingly, the strand size of the woven material should be relatively small; say less than 2 deniers. A microfiber material works particularly well with a strand size of about 1 denier.

[0034] The cleaning pad 152 extends the length of the wiper blades 162 which in turn extend the length of the pagewidth printhead. The pagewidth cleaning pad 152 cleans the entire length of the wiper blades simultaneously which reduces the time required for each wiping operation. Furthermore the length of the pagewidth cleaning pad inherently provides a large volume of the absorbent material for holding a relatively large amount of ink. With a greater capacity for absorbing ink, the cleaning pad 152 will be replaced less frequently.

Capping the Printhead

[0035] Figure 9 shows the first stage of capping the printhead ICs 30 with the capping maintenance station 198 mounted to the maintenance carousel 150. The maintenance carousel 150 is retracted away from the printhead ICs 30 as the lift cam 172 pushes down on the lift arms 158. The maintenance carousel 150, together with the maintenance encoder disk 204, are rotated until the first carousel rotation sensor 200 and the second carousel rotation sensor 202 determine that the printhead capper 198 is facing the printhead ICs 30.

[0036] As shown in Figure 10, the lift shaft 160 rotates the cam 172 so that the lift arms 158 move upwards to advance the maintenance carousel 150 towards the printhead ICs 30. The capper maintenance station 198 engages the underside of the LCP moldings 20 to seal the nozzles of the printhead ICs 30 in a relatively humid environment. The ordinary worker will understand that this prevents, or at least prolongs, the nozzles from drying out and clogging.

Uncapping the Printhead

[0037] Figure 11 shows the printhead ICs 30 being uncapped in preparation for printing. The lift shaft 160 is rotated so that the lift cam 172 pushes the carousel lift arms 158 downwards. The capping maintenance station 198 moves away from the LCP molding 20 to expose the printhead ICs 30.

Wiping the Printhead

[0038] Figure 12 shows the printhead ICs 30 being wiped by the wiper blades 162. As the capping station 198 is rotated away from the printhead, the blades of the wiper member 162 contact the underside of the LCP molding 20. As the carousel 150 continues to rotate, the wiper blades are drawn across the nozzle face of the printhead ICs 30 to wipe away any paper dust, dried ink or other contaminants. The wiper blades 162 are formed

from elastomeric material so that they resiliently flex and bend as they wipe over the printhead ICs 30. As the tip of each wiper blade is bent over, the side surface of each blade comes into wiping contact with the nozzle face. It will be appreciated that the broad flat side surface of the blades has greater contact with the nozzle face and is more effective at cleaning away contaminants.

Wiper Blade Cleaning

[0039] Figures 13 and 14 show the wiper blades 162 being cleaned. As shown in Figure 13, immediately after wiping the printhead ICs 30, the wiper blades 162 are rotated past the doctor blade 154. The function of the doctor blade 154 is discussed in greater detail above under the subheading "Doctor Blade".

[0040] After dragging the wiper blades 162 past the doctor blade 154, any residual dust and contaminants stuck to the blades is removed by the absorbent cleaning pad 152. This step is shown in Figure 14.

[0041] During this process the print platen maintenance station 206 is directly opposite the printhead ICs 30. If desired, the carousel can be lifted by rotation of the lift cam 172 so that the nozzles can fire into the absorbent material 208. Any colour mixing at the ink nozzles is immediately purged. Holes (not shown) drilled into the side of the tubular chassis 166 provides a fluid communication between the absorbent material 208 and the porous material 210 within the central cavity of the carousel shaft 166. Ink absorbed by the material 208 is drawn into, and retained by, the porous material 210. To drain the porous material 210, the carousel 150 can be provided with a vacuum attachment point (not shown) to draw the waste ink away.

[0042] With the wiper blades clean, the carousel 150 continues to rotate (see Figure 15) until the print platen 206 is again opposite the printhead ICs 30. As shown in Figure 16, the carousel is then lifted towards the printhead ICs 30 in readiness for printing. The sheets of media substrate are fed along the media feed path 22 and past the printhead ICs 30. For full bleed printing (printing to the very edges of the sheets of media), the media substrate can be held away from the platen 206 so that it does not get smeared with ink overspray. It will be understood that the absorbent material 208 is positioned within a recessed portion of the print platen 206 so that any overspray ink (usually about one millimetre either side of the paper edges) is kept away from surfaces that may contact the media substrate.

[0043] At the end of the print job or prior to the printer going into standby mode, the carousel 150 is retracted away from the printhead ICs 30 in rotated so that the printhead capping maintenance station 198 is again presented to the printhead. As shown in Figure 17, the lift shaft 160 rotates the lift cam so that the lift arms 158 move the printhead capping maintenance station 198 into sealing engagement with the underside of the LCP molding 20.

Printhead Maintenance Carousel

[0044] Figures 18, 19, 20 and 21 show the maintenance carousel in isolation. Figure 18 is a perspective view showing the wiper blades 162 and print platen 206. Figure 19 is a perspective view showing the printhead capper 198 and the wiper blades 162. Figure 20 is an exploded perspective showing the component parts of the maintenance carousel, and Figure 21 is a section view showing the component parts fully assembled.

[0045] The maintenance carousel has four printhead maintenance stations; a print platen 206, a wiper member 162, a printhead capper 198 and a spittoon/blotter 220. Each of the maintenance stations is mounted to its own outer chassis component. The outer chassis components fit around the carousel tubular shaft 166 and inter-engage each other to lock on to the shaft. At one end of the tubular shaft 166 is a carousel encoder disk 204 and a carousel spur gear 212 which is driven by the carousel rotation motor (not shown) described below. The tubular shaft is fixed to the spur gear or rotation therewith. The printhead maintenance stations rotate together with the tubular shaft by virtue of their firm compressive grip on the shaft's exterior.

[0046] The wiper blade outer chassis component 214 is an aluminium extrusion (or other suitable alloy) configured to securely hold the wiper blades 162. Similarly, the other outer chassis components are metal extrusions for securely mounting the softer elastomeric and or absorbent porous material of their respective maintenance stations. The outer chassis components for the print platen 216 and the printhead capper 198 have a series of identical locking lugs 226 along each of the longitudinal edges. The wiper member outer chassis component 214 and the spittoon/blotter outer chassis component 218 have complementary bayonet style slots for receiving the locking lugs 226. Each of the bayonet slots has a lug access aperture 228 adjacent a lug locking slot 230. Inserting the locking lugs 226 into the lug access aperture 228 of the adjacent outer chassis component, and then longitudinally sliding the components relative to each other will lock them on to the chassis tubular shaft 166.

[0047] To improve the friction, and therefore the locking engagement, between each of the maintenance stations and the chassis shaft 166, each of the printhead maintenance stations have an element with a curved shaft engagement surface 234. The print platen 206 has an absorbent member 224 with a curved shaft engagement surface 234 formed on one side. The spittoon/blotter outer chassis component 218 has a relatively large absorbent spittoon/blotter member 220 which also has a curved shaft engagement surface 234 formed on its interior face. Likewise, the outer chassis component for the printhead capper 198, and the common base of the wiper blades 162 work has curved shaft engagement surfaces 234.

[0048] The ordinary worker will appreciate that clamping the outer chassis to the inner chassis with the use of

interengaging locking formations minimises the amount of machining and assembly time while maintaining fine tolerances for precisely mounting the maintenance station structures. Furthermore, the outer chassis components can be assembled in different configurations. The wiper blade outer chassis component 214 can change positions with the spittoon/blotter chassis component 218. Similarly, the printhead capper 198 can swap with the print platen 206. In this way the maintenance station can be assembled in a manner that is optimised for the particular printer in which it will be installed.

Injection Molded Polymer Carousel Chassis

[0049] Figures 22 to 28 show another embodiment of the printhead maintenance carousel. These figures are schematic cross sections showing only the carousel and the lower portion of the printhead cartridge. It will be appreciated that the maintenance drive systems require simple and straightforward modifications in order to suit this embodiment of the carousel.

[0050] Figure 22 shows the LCP molding 20 of the printhead cartridge 2 adjacent the printhead maintenance carousel 150 with the print platen 206 presented to the printhead ICs 30. For clarity, Figure 29 shows the print platen 206 in isolation. In use, sheets of media substrate are fed along the media feed path 22. Between the nozzles of the printhead ICs 30 and the media feed path 22 is a printing gap 244. To maintain print quality, the gap 244 between the printhead IC nozzle face and the media surface should as close as possible to the nominal values specified during design. In commercially available printers this gap is about two millimetres. However, as print technology is refined, some printers have a printing gap of about one millimetre.

[0051] With the widespread popularity of digital photography, there is increasing demand for full bleed printing of colour images. "Full bleed printing" is printing to the very edges of the media surface. This will usually cause some "over spray" where ejected ink misses the edge of the media substrate and deposits on the supporting print platen. This over spray ink can then smear onto subsequent sheets of media.

[0052] The arrangement shown in Figure 22 deals with both these issues. The paper guide 238 on the LCP molding 20 defines the printing gap 244 during printing. However the print platen 206 has a guide surface 246 formed on its hard plastic base molding. The guide surface 246 directs the leading edge of the sheets towards the exit drive rollers or other drive mechanism. With minimal contact between the sheets of media and print platen 206, there is a greatly reduced likelihood of smearing from over sprayed ink during full bleed printing. Furthermore, placing the paper guide 238 on the LCP molding 20 immediately adjacent the printhead ICs 30 accurately maintains the gap 244 from the nozzles to the media surface.

[0053] Some printers in the Applicant's range use this to provide a printing gap 244 of 0.7 millimetres. However

this can be further reduced by flattening the bead of encapsulant material 240 adjacent the printhead ICs 30. Power and data is transmitted to the printhead ICs 30 by the flex PCB 242 mounted to the exterior of the LCP molding 20. The contacts of the flex PCB 242 are electrically connected to the contacts of the printhead ICs 30 by a line of wire bonds (not shown). To protect the wire bonds, they are encapsulated in an epoxy material referred to as encapsulant. The Applicant has developed several techniques for flattening the profile of the wire bonds and the bead of encapsulant 240 covering them. This in turn allows the printing gap 244 to be further reduced.

[0054] The print platen 206 has an indentation or central recessed portion 248 which is directly opposite the nozzles of the printhead ICs 30. Any over spray ink will be in this region of the platen 206. Recessing this region away from the remainder of the platen ensures that the media substrate will not get smeared with wet over spray ink. The surface of the central recessed 248 is in fluid communication with an absorbent fibrous element 250. In turn, the fibrous element 250 is in fluid communication with porous material 254 in the centre of the chassis 236 by capillary tubes 252. Over sprayed ink is wicked into the fibrous element 250 and drawn into the porous material 254 by capillary action through the tubes 252.

[0055] Figure 23 shows the carousel 150 rotated such that the printhead priming station 262 is presented to the printhead ICs 30. Figure 30 shows the printhead priming station 272 and its structural features in isolation. The printhead priming station has an elastomeric skirt 256 surrounding a priming contact pad 258 formed of porous material. The elastomeric skirt and the priming contact pad are co-molded together with a rigid polymer base 260 which securely mounts to the injection molded chassis 236.

[0056] Whenever the printhead cartridge 2 is replaced, it needs to be primed with ink. Priming is notoriously wasteful as the ink is typically forced through the nozzles until the entire printhead structure has purged any air bubbles. In the time it takes for the air to be cleared from the multitude of conduits extending through the printhead, a significant amount of ink has been wasted.

[0057] To combat this, the maintenance carousel 150 is raised so that the priming contact pad 258 covers the nozzles of the printhead ICs 30. Holding the contact pad 258 against the nozzle array as it is primed under pressure significantly reduces the volume of ink purged through the nozzles. The porous material partially obstructs the nozzles to constrict the flow of ink. However the flow of air out of the nozzles is much less constricted, so the overall priming process is not delayed because of the flow obstruction generated by the porous material. The elastomeric skirt 256 seals against the underside of the LCP molding 22 to capture any excess ink that may flow from the sides of the contact pad 258. Flow apertures 264 formed in the rigid polymer base 260 allows the ink absorbed by the pad 258 and any excess ink to flow to

the absorbent fibrous element 250 (identical to that used by the print platen 206). As with the print platen 206, ink in the fibrous element 250 is drawn into the porous material 254 within the injection molded chassis 236 by the capillary tubes 252.

[0058] By using the printhead priming station 262, the amount of wasted ink is significantly reduced. Without the priming station, the volume of ink wasted when priming the pagewidth printhead is typically about two millilitres per colour. With the priming station 262, this is reduced to 0.1 millilitres per colour.

[0059] The priming contact pad 258 need not be formed of porous material. Instead, the pad can be formed from the same elastomeric material as the surrounding skirt 256. In this case, the contact pad 258 needs to have a particular surface roughness. The surface that engages the nozzle face of the printhead ICs 30, should be rough at the 2 to 4 micron scale, but smooth and compliant at the 20 micron scale. This type of surface roughness allows air to escape from between the nozzle face and contact pad, but only a small amount of ink.

[0060] Figure 24 shows the maintenance carousel 150 with the wiping station 266 presented to the printhead ICs 30. The wiping station is shown in isolation in Figure 31. The wiping station 266 is also a co-molded structure with the soft elastomeric wiper blades 268 supported on a hard plastic base 270. To wipe the nozzle face of the printhead ICs 30, the carousel chassis 236 is raised and then rotated so that the wiper blades 268 wipe across the nozzle face. Ordinarily, the carousel chassis 236 is rotated so that the wiper blades 268 wipe towards the encapsulation bead 240. As discussed in the Applicant's co-pending application USSN (our docket RRE015US) incorporated by cross-reference above, the encapsulant bead 240 can be profiled to assist the dust and contaminants to lodge on the face of the wiper blade 268. However, the maintenance drive (not shown) can easily be configured to rotate the chassis 236 in both directions if wiping in two directions proves more effective. Similarly, the number of wipes across the printhead ICs 30 is easily varied by changing the number of rotations the maintenance drive is programmed to perform for each wiping operation.

[0061] In Figure 25, the maintenance carousel 150 is shown with the printhead capper 272 presented to the printhead ICs 30. Figure 32 shows the capper in isolation to better illustrate its structure. The capper 272 has a perimeter seal 274 formed of soft elastomeric material. The perimeter seal 274 is co-molded with its hard plastic base 276. The printhead capper 272 reduces the rate of nozzle drying when the printer is idle. The seal between the perimeter seal 274 and the underside of the LCP molding 20 need not be completely air tight as the capper is being used to prime printhead using a suction force. In fact the hard plastic base 276 should include an air breather hole 278 so that the nozzles do not flood by the suction caused as the printhead is uncapped. To cap the printhead, the chassis 236 is rotated until the printhead

capper 272 is presented to the printhead ICs 30. The chassis 236 is then raised until the perimeter seal 274 engages the printhead cartridge 2.

[0062] Figure 26 shows the inclusion of the wiper blade cleaning pad 152. As with the first embodiment described above, the cleaning pad 152 is mounted in the printer so that the wiper blades 268 move across the surface of the pad 152 as the maintenance carousel 150 is rotated. By positioning the cleaning pad 152 such that the chassis 236 needs to be retracted from the printhead ICs 30 in order to allow the wiper blades 268 to contact pad, the chassis 236 can be rotated at relatively high speeds for a comprehensive clean of the wiper blades 268 while not risking any damaging contact with the printhead ICs 30. Furthermore the cleaning pad 152 can be wetted with a surfactant to better remove contaminants from the wiper blades surface.

[0063] Figure 27 shows the injection molded chassis 236 in isolation. The chassis is symmetrical about two planes extending through the central longitudinal axis 282. This symmetry is important because an injection molded chassis extending the length of pagewidth printhead, is prone to deform and bend as it cools if the cross section is not symmetrical. With a symmetrical cross-section, the shrinkage of the chassis as it cools is also symmetrical.

[0064] The chassis 236 has four maintenance station mounting sockets 276 formed in its exterior surface. The sockets 276 are identical so that they can receive any one of the various maintenance stations (206, 266, 262, 272). In this way the maintenance stations become interchangeable modules and the order which the maintenance stations are presented to the printhead can be changed to suit different printers. Furthermore, if the maintenance stations themselves are modified, their standard sockets ensure they are easily incorporated into the existing production line with a minimum of retooling. The maintenance stations are secured in the sockets with adhesive but other methods such as an ultra sonic spot weld or mechanical interengagement would also be suitable.

[0065] As shown in Figure 28, the mold has four sliders 278 and a central core 288. Each of the sliders 278 has columnar features 280 to form the conduits connecting the fibrous wicking pads to the porous material 219 in the central cavity. The line of draw for each slider is radially outwards from the chassis 236 while the core 288 is withdrawn longitudinally (it will be appreciated that the core is not a precisely a cylinder, but a truncated cone to provide the necessary draft). Injection molding of polymer components is very well suited to high-volume, low-cost production. Furthermore, the symmetrical structure of the chassis and uniform shrinkage maintain good tolerances to keep the maintenance stations extending parallel to the printhead ICs. However, other fabrication techniques are possible; for example, shock wave compressed polymer powder or similar. Furthermore, a surface treatment to increase hydrophilicity can assist the

flow of ink to the capillary tubes 252 and ultimately the porous material 210 within the chassis 236. In some printer designs, the chassis is configured for connection to a vacuum source to periodically drain ink from the porous material 210.

Five Maintenance Station Embodiment

[0066] Figure 34 shows an embodiment of the printhead maintenance carousel 150 with five different maintenance stations: a print platen 206, a printhead wiper 266, a printhead capper 272, a priming station 262 and a spittoon 284. The spittoon 284 (shown in isolation in Figure 33) has a relatively simple structure - the spittoon face 284 presents flat to the printhead and has apertures (not shown) for fluid communication with the fibrous element 250 retained in its hard plastic base.

[0067] The five station maintenance carousel 150 adds a spittoon 284 to allow the printer to use major ink purges as part of the maintenance regime. The four station carousel of Figures 22-25, will accommodate minor ink purges or 'spitting cycles' using the print platen 206 and or the capper 272. A minor spitting cycle is used after a nozzle face wipe or as an inter-page spit during a print job to keep the nozzles wet. However, in the event that the printhead needs to be recovered from deprime, gross color mixing, large-scale nozzle drying and so on, it is likely that a major spitting cycle will be required - one which is beyond the capacity of the platen or the capper.

[0068] The spittoon 284 has large apertures in its face 286 or a series of retaining ribs to hold the fibrous wicking material 250 in the hard plastic base. This keeps the fibrous element 250 very open to a potentially dense spray of ink. One face of the fibrous element 250 presses against the capillary tubes 252 to enhance the flow to the porous material 254 in the central cavity of the chassis 236.

[0069] The five socket chassis 236 is injection molded using five sliders configured at 72 degrees to each other, or six sliders at 60 degrees to each other. Similarly, a maintenance carousel with more than five stations is also possible. If the nozzle face is prone to collecting dried ink, it can be difficult to remove with a wiper alone. In these situations, the printer may require a station (not shown) for jetting ink solvent or other cleaning fluid onto the nozzle face. This can be incorporated instead of, or in addition to the spittoon.

Wiper Variants

[0070] Figure 35 to 46 show a range of different structures that the wiper can take. Wiping the nozzle face of printhead is an effective way of removing paper dust, ink floods, dried ink or other contaminants. The ordinary worker will appreciate that countless different wiper configurations are possible, of which, the majority will be unsuitable for any particular printer. The functional effectiveness of wiper (in terms of cleaning the printhead) must

be weighed against the production costs, the intended operational life, the size and weight constraints and other considerations.

5 Single Contact Blade

[0071] Figure 35 shows a wiper maintenance station 266 with a single elastomeric blade 290 mounted in the hard plastic base 270 such that it extends normal to the media feed direction. A single wiper blade extending the length of the nozzle array is a simple wiping arrangement with low production and assembly costs. In light of this, a single blade wiper is suited to printers and the lower end of the price range. The higher production volumes favor cost efficient manufacturing techniques and straightforward assembly of the printer components. This may entail some compromise in terms of the operational life of the unit, or the speed and efficiency with which the wiper cleans the printhead. However the single blade design is compact and if it does not effectively clean the nozzle face in a single traverse, the maintenance drive can simply repeat the wiping operation until the printhead is clean.

25 Multiple Contact Blades

[0072] Figures 36, 43A, 43 and 46 show wiper maintenance stations 266 with multiple, parallel blades. In Figure 36, the twin parallel blades 292 are identical and extend normal to the media feed direction. Both blades 292 are separately mounted to the hard plastic base 270 so as to operate independently. In Figure 46, the blades are non-identical. The first and second blades (294 and 296 respectively) are different widths (or otherwise different cross sectional profiles) and durometer values (hardness and viscoelasticity). Each blade may be optimised to remove particular types of contaminant. However, they are separately mounted in the hard plastic base 270 for independent operation. In contrast, the multiple blade element of Figures 43A and 43B has smaller, shorter blades 300 all mounted to a common elastomeric base 298, which is in turn secured to the hard plastic base 270. This is a generally more compliant structure that has a relatively large surface area in contact with the nozzle face with each wipe. However, the thin soft blades wear and perish at a greater rate than the larger and more robust blades.

[0073] With multiple parallel blades wiping across the nozzle face, a single traverse by the wiper member will collect more of the dust and contaminants. While a multiple blade design is less compact than a single blade, each wiping operation is quicker and more effective. Hence the printhead can be wiped between pages during the print job and any preliminary maintenance regime performed prior to a print job is completed in a short time.

Single Skew Blade

[0074] Figure 37 shows a wiper maintenance station 266 with a single blade 302 mounted in the hard plastic base 270 such that it is skew to the wiping direction. It will be appreciated that the wiping direction is normal to the longitudinal extent of the plastic base 270.

[0075] A single wiper blade is a simple wiping arrangement with low production and assembly costs. Furthermore, by mounting the blade so that it is skew to the wiping direction, the nozzle face will be in contact with only one section of blade and any time during the traverse of the wiper member. With only one section in contact with the nozzle face, the blade does not buckle or curl because of inconsistent contact pressure along its full length. This ensures sufficient contact pressure between the wiper blade and all of the nozzle face without needing to precisely line the blade so that it is completely parallel to the nozzle face. This allows the manufacturing tolerances to be relaxed so that higher volume low-cost production techniques can be employed. This may entail some compromise in terms of increasing the distance that the wiper member must travel in order to clean the printhead, and therefore increasing the time required from each wiping operation. However the reduced manufacturing costs outweigh these potential disadvantages.

Independent Contact Blades

[0076] Figure 38 shows a wiper maintenance station 266 with two sectioned blades 304 mounted in the hard plastic base 270. Each of the individual blade sections 306 that make up the complete blades 304 mounted in the hard plastic base 270 for independent movement relative to each other. The individual blade sections 306 in each blade 304 are positioned so that they are out of registration with each other with respect to the wiping direction. In this way, the nozzles that are not wiped by the first blade 304 because they are positioned in a gap between two blade sections 306, will be wiped by a blade section 306 in the second blade 304.

[0077] Wiping the nozzle face of pagewidth printhead with a single long blade can be ineffective. Inconsistent contact pressure between the blade and the nozzle face can cause the blade to buckle or curl at certain sections along its length. In these sections the contact pressure can be insufficient or there maybe no contact between the blade and the nozzle face. A wiper blade divided into individual blade sections can address this problem. Each section is capable of moving relative to its adjacent sections so any inconsistencies in the contact force, will not cause buckling or curling in other sections of blade. In this may contact pressure is maintained at the nozzle face is clean effectively.

Nozzle Face Wiper Having Multiple Skew Blades

[0078] In Figure 39, the wiper maintenance station 266

has a series of independent blades 308 mounted in the hard plastic base 270 such that they are skew to the wiping direction. The blades 308 are positioned so that the lateral extent (with respect the wiping direction) of each blade (X) has some overlap (Z) with the lateral extent of its adjacent blades (Y). By mounting the wiper blade so that it is skew to the wiping direction, the nozzle face will be in contact with only one section of blade and any time during the traverse of the wiper member. With only one section in contact with the nozzle face, the blade does not buckle or curl because of inconsistent contact pressure along its full length. This ensures sufficient contact pressure between the wiper blade and all of the nozzle face without needing to align the blade so that it is precisely parallel to the nozzle face. This allows the manufacturing tolerances to be relaxed so that high volume low-cost production techniques can be employed. A single skew blade will achieve this but it will increase the distance that the wiper member must travel in order to clean the printhead, and therefore increasing the time required from each wiping operation. In light of this, the invention uses a series of adjacent skew blades, each individual blade wiping a corresponding portion of the nozzle array. Multiple blades involve higher manufacturing costs than a single blade but in certain applications, the compact design and quicker operation outweigh these potential disadvantages.

Wiper with Array of Pads

[0079] In Figures 40 and 44 the wiping maintenance stations 266 use an array of contact pads 310 instead of any blade configurations. The individual pads 312 maybe short squad cylinders of an elastomeric material individually mounted into the hard plastic base 270 or a cylindrical soft fibre brush similar to the format often used for silicon wafer cleaning. As discussed above, wiping the nozzle face of pagewidth printhead with a single long contact surface can be ineffective. Inconsistent contact pressure between the wiping surface and the nozzle face can cause the contact pressure to be insufficient or non-existent in some areas.

[0080] Using a wiping surface that has been divided into an array 310 of individual contact pads allows each pad to move relative to its adjacent pads so any inconsistencies in the contact force will vary the amount each pad compresses and deforms individually. Relatively high compression of one pad will not necessarily transfer compressive forces to its adjacent pad. In this way, uniform contact pressure is maintained at the nozzle face is cleaned more effectively.

Sinusoidal Blade

[0081] In the wiping maintenance station 266 shown in Figure 41, the single blade 314 is mounted into the hard plastic base 270 such that it follows a sinusoidal path. As previously discussed, wiping the nozzle face of

pagewidth printhead with a single long contact surface can be ineffective. Inconsistent contact pressure between the wiping surface and the nozzle face can cause the contact pressure to be insufficient or non-existent in some areas. One of the reasons that the contact pressure will vary is inaccurate movement of the wiper surface relative to the nozzle face. If the support structure for the wiping surface is not completely parallel to the nozzle face over the entire length of travel during the wiping operation, there will be areas of low contact pressure which may not be properly cleaned. As explained in relation to the skew mounted blades, it is possible to avoid this by positioning the wiper blade so that it is angled relative to feed wiping direction and the printhead nozzle face. In this way, only one portion of the wiper blade contacts the nozzle face at any time during the wiping operation. Also, a small angle between the blade and the wiping direction improves the cleaning and effectiveness of the wipe. When the blade moves over the nozzle face at an incline, more contact points between the blade and the nozzle face give better contaminant removal. This ameliorates any problems caused by inconsistent contact pressure but it requires the wiper blade to travel further for each wiping operation. As discussed above, inaccuracies in the movement of wiper surface relative to the nozzle face is a source of insufficient contact pressure. Increasing the length of wiper travel is also counter to compact design.

[0082] Using a wiping blade that has a zigzag or sinusoidal shape wipes the nozzle face with a number wiper sections that are inclined to the media feed direction. This configuration also keeps the length of travel of the wiper member relative to the printhead small enough to remain accurate and compact.

Single Blade with Non-Linear Contact Surface

[0083] Figure 42 shows the wiping maintenance station 266 with a single blade 316 having two linear sections mounted on the hard plastic base 270 at an angle to each other, and skew to the wiping direction. As previously discussed, wiping the nozzle face of pagewidth printhead with a single long contact surface can cause the contact pressure to be insufficient or non-existent in some areas. Angling the blade relative to the wiping direction and the printhead nozzle face means that only one portion of the wiper blade contacts the nozzle face at any time during the wiping operation. This keeps the contact pressure more uniform but it requires the wiper blade to travel further for each wiping operation. As discussed above, inaccuracies in the movement of wiper surface relative to the nozzle face source of insufficient contact pressure. Increasing the length of wiper travel only increases the risk of such inaccuracies.

[0084] By using a wiping surface that has an angled or curved shape so that the majority of the nozzle face is wiped with a wiper section that is inclined to the media feed direction while reducing the length of travel of the

wiper member relative to the printhead. The ordinary worker will understand that the contact blade can have a shallow V-shape or U-shape. Furthermore if the leading edge of the blade 318 is the intersection of the two linear sections (or the curved section of the U-shaped blade), the Applicant has found that there is less blade wear because of the additional support provided to the initial point of contact with the nozzle face.

10 Fibrous Pad

[0085] Figure 45 shows a printhead wiper maintenance station 266 with a fibrous pad 320 mounted to the hard plastic base 270. A fibrous pad 320 is particularly effective for wiping the nozzle face. The pad presents many points of contact with the nozzle face so that the fibres can mechanically engage with solid contaminants and will wick away liquid contaminants like ink floods and so on. However, once the fibrous pad has cleaned the nozzle face, it is difficult to remove the contaminants from the fibrous pad. After a large number of wiping operations, the fibrous pad can be heavily laden with contaminants and may no longer clean the nozzle face effectively. However, printers intended to have a short operational life, or printers that allow the wiper to be replaced, a fibrous pad will offer the most effective wiper.

Combination Wiper Maintenance Stations

[0086] It will be appreciated that some printhead designs will be most effectively cleaned by a wiper that has a combination of the above wiping structures. For example a single blade in combination with a series of skew blades, or a series of parallel blades with a fibrous pad in between. The combination wiper maintenance station can be derived by choosing the specific wiping structures on the basis of their individual merits and strength.

Printhead Maintenance Facility Drive System

[0087] Figures 47 to 50 show the media feed drive and the printhead maintenance drive in greater detail. Figure 48 shows the printhead maintenance carousel 150 and the drive systems in isolation. The maintenance carousel 150 is shown with the wiper blades 162 presented to the printhead (not shown). The perspective shown in Figure 48 reveals the paper exit guide 322 leading to the exit drive roller 178. On the other side of the wiper blades 162 the main drive roller shaft 186 is shown extending from the main drive roller pulley 330. This pulley is driven by the main drive roller belt 192 which engages the media feed motor 190. The media feed drive belt 182 synchronises the rotation of the main drive roller 186 and the exit roller 178.

[0088] The exploded perspective in Figure 49 shows the individual components in greater detail. In particular, this perspective best illustrates the balanced carousel lift mechanism. The carousel lift drive shaft 160 extends be-

tween two identical carousel lift cams 172. One end of the carousel lift shaft 160 is keyed to the carousel lift spur gear 174. The spur gear 174 meshes with the worm gear 176 driven by the carousel lift motor 324. The carousel lift rotation sensor 334 provides feedback to the print engine controller (not shown) which can determine the displacement of the carousel from the printhead by the angular displacement of the cams 172.

[0089] The carousel lift cams 172 contact respective carousel lift arms 158 via the cam engaging rollers 168 (it will be appreciated that the cam engaging rollers could equally be a surface of low friction material such as high density polyethylene-HDPE). As the cams 172 are identical and identically mounted to the carousel lift shaft 160 the displacement of the carousel lift arms 158 is likewise identical. Figure 47 is a section view taken along line 7-7 of Figure 2A with the printhead cartridge 2 removed and the printhead maintenance carousel 150 also removed. This figure provides a clear view of the carousel lift spur gear 174, its adjacent lift cam 172 and the corresponding carousel lift arm 158. As the lift arms 158 are equidistant from the midpoint of the carousel 150, the carousel lift drive is completely balanced and symmetrical when lifting and lowering the carousel. This serves to keep the various printhead maintenance stations parallel to the longitudinal extent of the printhead ICs.

[0090] The carousel rotation drive is best illustrated in the enlarged exploded partial perspective of Figure 50. The carousel rotation motor 326 is mounted to the side of the carousel lift structure 170. The stepper motor sensor 328 provides feedback to the print engine controller (PEC) regarding the speed and rotation of the motor 326. The carousel rotation motor 326 drives the idler gear 332 which in turn, drives the reduction gear (not shown) on the obscured side of the carousel lift structure 170. The reduction gear meshes with the carousel spur gear 212 which is keyed to the carousel chassis for rotation therewith.

[0091] As the carousel rotation and the carousel lift the controlled by a separate independent drives, each drive powered by a stepper motor that provides the PEC with with feedback as to motor speed and rotation, the printer has a broad range of maintenance procedures from which to choose. The carousel rotation motor 326 can be driven in either direction and at the variable speeds. Accordingly the nozzle face can be wiped in either direction and the wiper blades can be cleaned against the absorbent pad 152 in both directions. This is particularly useful if paper dust or other contaminants passed to the nozzle face because of a mechanical engagement with the surface irregularity on the nozzle face. Wiping in the opposite direction will often dislodge such mechanical engagements. It is also useful to reduce the speed of the wiper blades 162 as they come into contact with the nozzle face and then increase speed once the blades have disengaged the nozzle face. Indeed the wiper blades 162 can slow down for initial contact with the nozzle face and subsequently increase speed while wiping.

[0092] Similarly, the wiper blades 162 can be moved past the doctor blade 154 at a greater speed than the blades are moved over the cleaning pad 152. The blades 162 can be wiped in both directions with any number of revolutions in either direction. Furthermore the order in which the various maintenance stations are presented to the printhead can be easily programmed into the PEC and or left to the discretion of the user.

[0093] The present invention has been described herein by way of example only. The ordinary worker will readily recognise many variations and modifications which do not depart from the scope of the invention as claimed.

Claims

1. A replaceable printhead cartridge (2) for an inkjet printer, the printhead cartridge comprising:

an elongate cartridge body (44) configured for user insertion and removal from the ink jet printer, the cartridge body having an elongate structure (68) with a plurality of longitudinally extending channels (24);

a pagewidth printhead mounted on the elongate structure (68), the pagewidth printhead defining an array of nozzles for ejecting ink onto a media substrate;

a first fluid coupling (48) positioned at one end of the elongate structure; and,

a second fluid coupling (50) positioned at an opposite end of the elongate structure,

wherein the first and second fluid couplings each has an interface plate supporting a plurality of spouts (52,54) positioned for sealed engagement with corresponding apertures in a complementary socket of the printer, said spouts being in fluid communication with the respective ends of corresponding longitudinally extending channels (24),

characterized in that:

the spouts extend from respective interface plates transversely with respect to a longitudinal axis of the pagewidth printhead.

2. A printhead cartridge according to claim 1 wherein each interface plate has surface formations individually associated with each of the spouts respectively, the surface formations defining preferred flow paths along the interface plate for any residual ink draining away from the spouts under gravity, the preferred flow paths being configured to avoid any other spouts.
3. A printhead cartridge according to claim 2 wherein the surface formations are grooves in the interface

plate.

4. A printhead cartridge according to claim 3 wherein the spouts are arranged in a circular formation on the interface plate. 5
5. A printhead cartridge according to claim 1 wherein each of the spouts has an end formation configured for engagement with a shut off valve in the complementary socket of the printer. 10
6. A printhead cartridge according to claim 5 wherein each of the spouts has at least one aperture in a side wall thereof. 15
7. A printhead cartridge according to claim 1 wherein the pagewidth printhead has a plurality of printhead ICs mounted to the elongate structure such that the printhead ICs are aligned with each other and the longitudinal extent of the longitudinally extending channels. 20
8. A printhead cartridge according to claim 7 wherein the elongate structure has a series of fine conduits extending from each of the longitudinally extending channels to the printhead ICs. 25
9. A printhead cartridge according to claim 1 wherein the second fluid coupling is structurally a mirror image of the first fluid coupling. 30

Patentansprüche

1. Austauschbare Druckkopfpatrone (2) für einen Tintenstrahldrucker, wobei die Druckkopfpatrone Folgendes aufweist:
 - einen länglichen Patronenkörper (44), der für die Einsetzung und die Entnahme aus dem Tintenstrahldrucker durch einen Benutzer konfiguriert ist, wobei der Patronenkörper eine längliche Struktur (68) mit einer Mehrzahl von sich in der Längsrichtung erstreckenden Kanälen (24) hat; einen Druckkopf mit der Breite einer Seite, der an der länglichen Struktur (68) befestigt ist, wobei der Druckkopf mit der Breite einer Seite eine Anordnung von Düsen für das Ausstoßen von Tinte auf ein Mediensubstrat definiert; eine erste Strömungskupplung (48), die an einem Ende der länglichen Struktur positioniert ist; und eine zweite Strömungskupplung (50), die an einem entgegengesetzten Ende der länglichen Struktur positioniert ist, 40 45 50 55
- wobei die erste und die zweite Strömungskupplung jeweils eine Schnittstellenplatte haben, die eine

Mehrzahl von Tüllen (52, 54) stützt, die für den Dichtungseingriff mit entsprechenden Öffnungen in einer komplementären Buchse des Druckers positioniert sind, wobei die Tüllen in Fluidkommunikation mit den jeweiligen Enden der entsprechenden sich in der Längsrichtung erstreckenden Kanäle (24) stehen, **dadurch gekennzeichnet, dass**

sich die Tüllen von den jeweiligen Schnittstellenplatten quer in Bezug auf eine Längsachse des Druckkopfs mit der Breite einer Seite erstrecken.

2. Druckkopfpatrone nach Anspruch 1, wobei jede Schnittstellenplatte Oberflächeninformationen hat, die individuell zu jeder der jeweiligen Tüllen gehören, wobei die Oberflächeninformationen bevorzugte Strömungswege entlang der Schnittstellenplatte für alle Tintenrückstände definieren, die von den Tüllen unter Schwerkraft ablaufen, wobei die bevorzugten Strömungswege konfiguriert sind, alle anderen Tüllen zu vermeiden.
3. Druckkopfpatrone nach Anspruch 2, wobei die Oberflächeninformationen Rillen in der Schnittstellenplatte sind.
4. Druckkopfpatrone nach Anspruch 3, wobei die Tüllen in einer kreisförmigen Formation auf der Schnittstellenplatte angeordnet sind.
5. Druckkopfpatrone nach Anspruch 1, wobei jede der Tüllen eine Endformation hat, die für den Eingriff mit einem Absperrventil in der komplementären Buchse des Druckers konfiguriert ist.
6. Druckkopfpatrone nach Anspruch 5, wobei jede der Tüllen mindestens eine Öffnung in einer Seitenwand davon hat.
7. Druckkopfpatrone nach Anspruch 1, wobei der Druckkopf mit der Breite einer Seite eine Mehrzahl von Druckkopf-ICs hat, die an der länglichen Struktur derart befestigt sind, dass die Druckkopf-ICs jeweils aufeinander und auf die Längserstreckung der sich in der Längsrichtung erstreckenden Kanäle ausgerichtet sind.
8. Druckkopfpatrone nach Anspruch 7, wobei die längliche Struktur eine Reihe von feinen Leitungen hat, die sich von jedem der sich in der Längsrichtung erstreckenden Kanäle zu den Druckkopf-ICs erstrecken.
9. Druckkopfpatrone nach Anspruch 1, wobei die zweite Strömungskupplung strukturell ein Spiegelbild der ersten Strömungskupplung ist.

Revendications

1. - Cartouche de tête d'impression remplaçable (2) pour une imprimante à jet d'encre, la cartouche de tête d'impression comprenant :

- un corps de cartouche allongé (44) configuré pour que l'utilisateur puisse l'introduire dans l'imprimante à jet d'encre et l'en retirer, le corps de cartouche ayant une structure allongée (68) avec plusieurs canaux (24) s'étendant longitudinalement ;
- une tête d'impression largeur de page montée sur la structure allongée (68), la tête d'impression largeur de page définissant un réseau de buses pour éjecter de l'encre sur un substrat d'impression ;
- un premier raccord de fluide (48) positionné à une extrémité de la structure allongée ; et
- un second raccord de fluide (50) positionné à une extrémité opposée de la structure allongée,

les premier et second raccords de fluide ayant chacun une plaque d'interface supportant plusieurs becs (52, 54) positionnés en vue d'un engagement étanche avec des ouvertures correspondantes dans une douille complémentaire de l'imprimante, lesdits becs étant en communication fluidique avec les extrémités respectives de canaux correspondants (24) s'étendant longitudinalement,

caractérisée par le fait que :

- les becs s'étendent à partir de plaques d'interface respectives transversalement par rapport à un axe longitudinal de la tête d'impression largeur de page.

2. - Cartouche de tête d'impression selon la revendication 1, dans laquelle chaque plaque d'interface a des formations de surface associées individuellement avec respectivement chacun des becs, les formations de surface définissant des trajets d'écoulement préférés le long de la plaque d'interface pour toute encre résiduelle évacuée par drainage à partir des becs sous l'effet de la gravité, les trajets d'écoulement préférés étant configurés pour éviter tous autres becs verseurs.

3. - Cartouche de tête d'impression selon la revendication 2, dans laquelle les formations de surface sont des rainures dans la plaque d'interface.

4. - Cartouche de tête d'impression selon la revendication 3, dans laquelle les becs sont arrangés en une formation circulaire sur la plaque d'interface.

5. - Cartouche de tête d'impression selon la revendication 1, dans laquelle chacun des becs a une for-

mation d'extrémité configurée pour un engagement avec une soupape de fermeture dans la douille complémentaire de l'imprimante.

6. - Cartouche de tête d'impression selon la revendication 5, dans laquelle chacun des becs a au moins une ouverture dans une paroi latérale de celui-ci.

7. - Cartouche de tête d'impression selon la revendication 1, dans laquelle la tête d'impression largeur de page a plusieurs CI de tête d'impression montés sur la structure allongée de telle sorte que les CI de tête d'impression sont alignés entre eux et avec l'étendue longitudinale des canaux s'étendant longitudinalement.

8. - Cartouche de tête d'impression selon la revendication 7, dans laquelle la structure allongée a une série de fins conduits s'étendant de chacun des canaux s'étendant longitudinalement aux CI de tête d'impression.

9. - Cartouche de tête d'impression selon la revendication 1, dans laquelle le second raccord de fluide est structuralement une image-miroir du premier raccord de fluide.

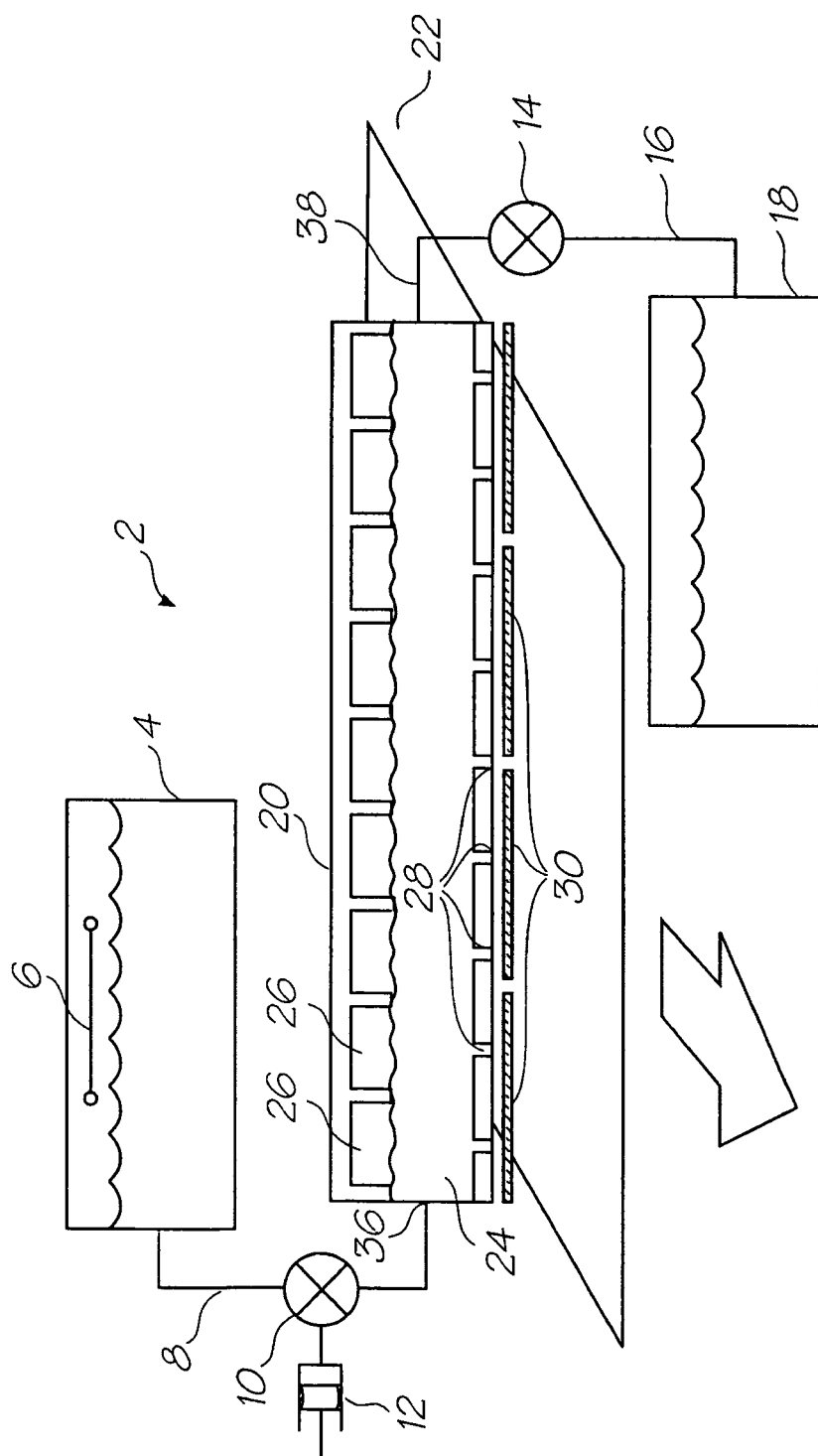
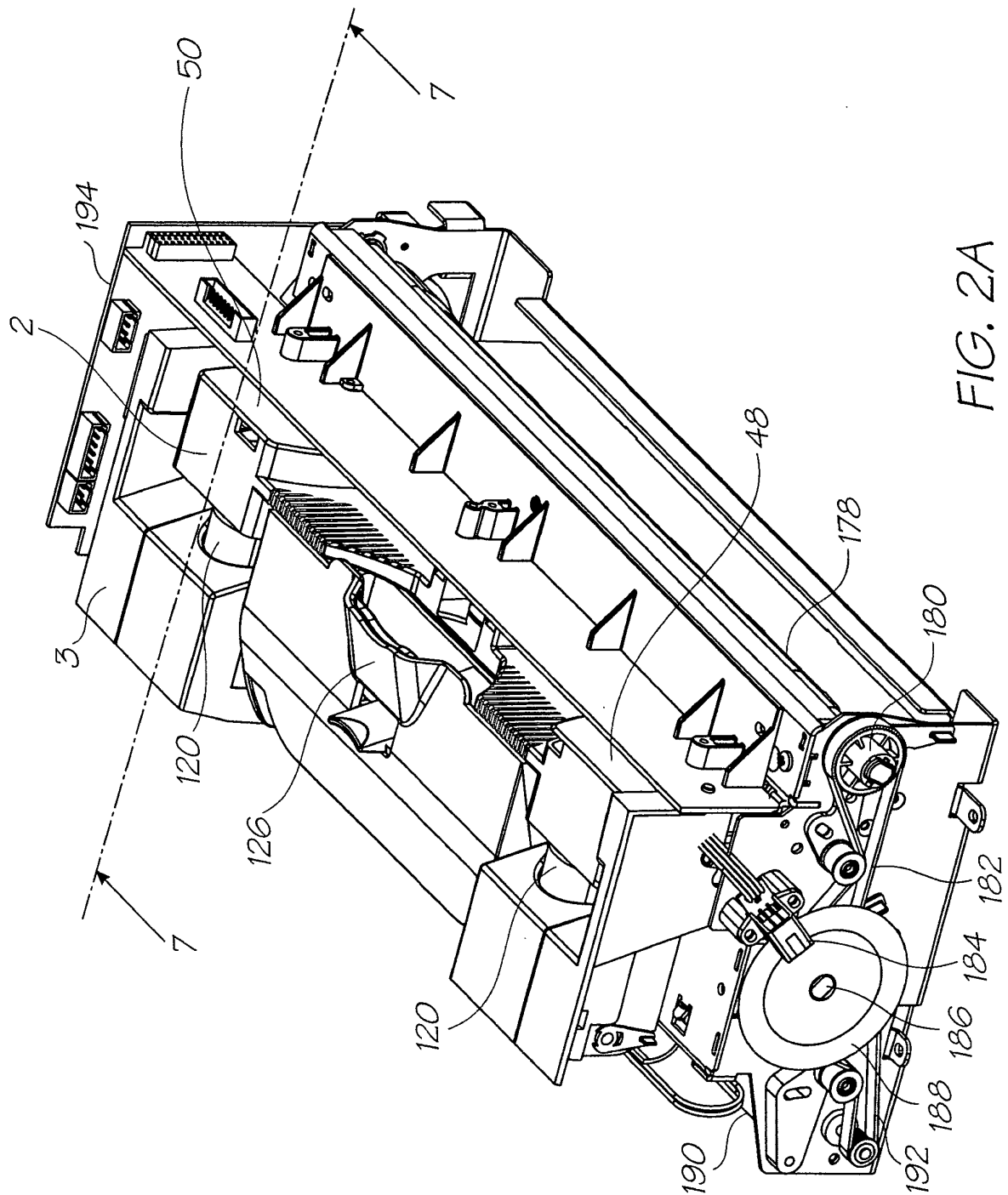


FIG. 1



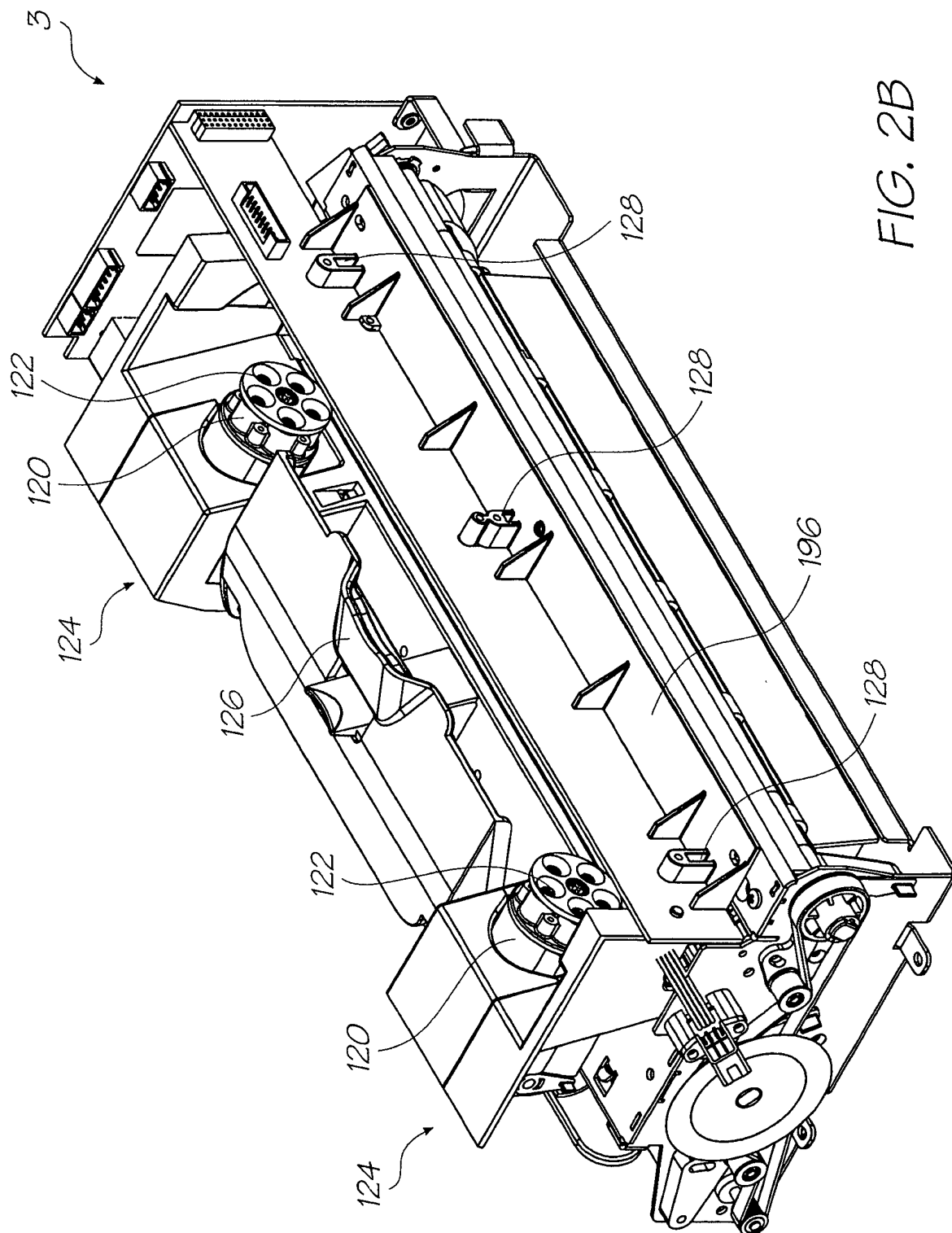
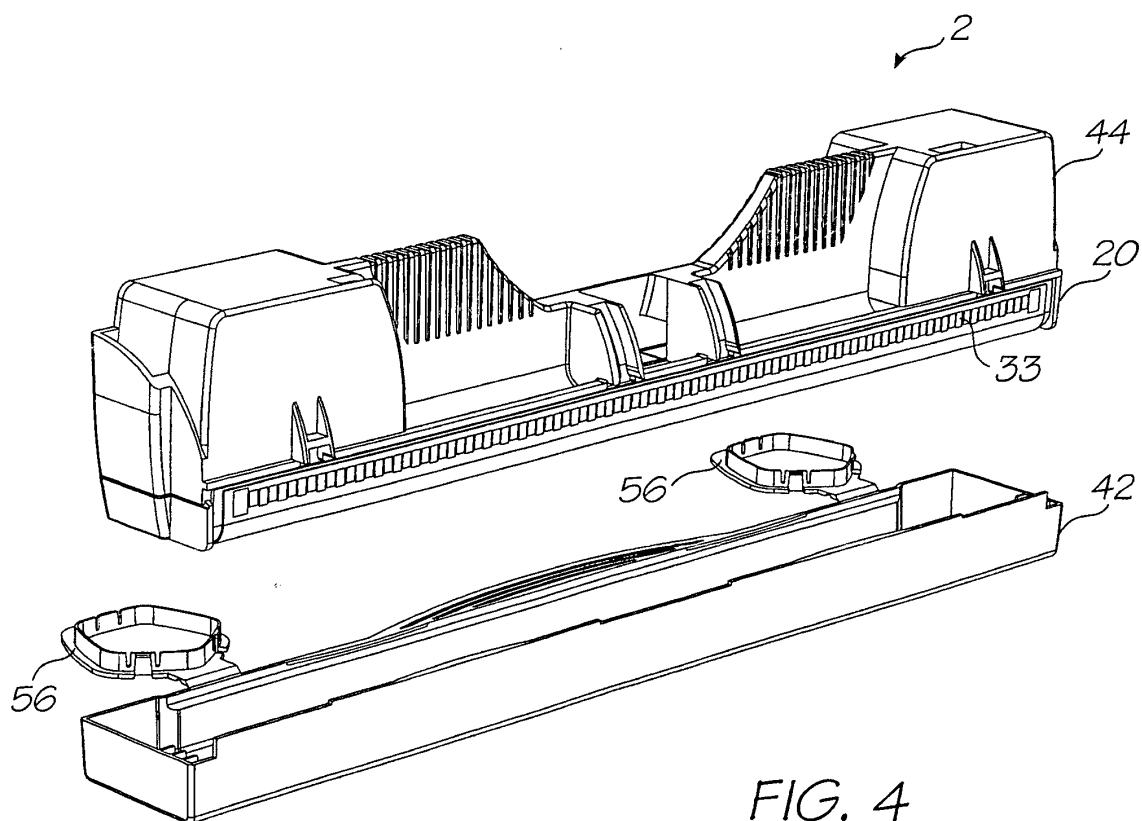
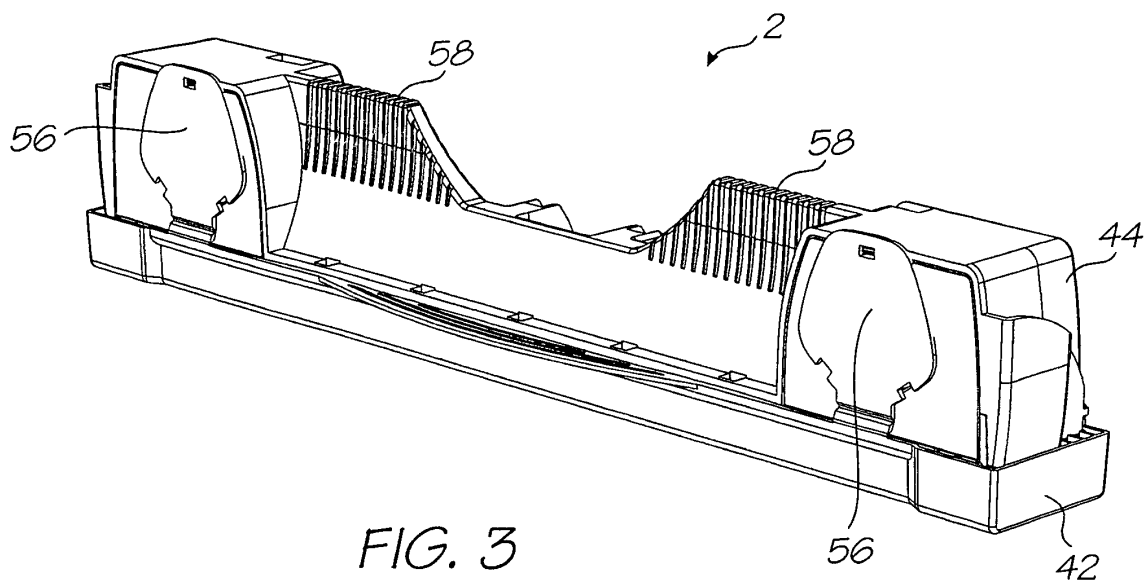


FIG. 2B



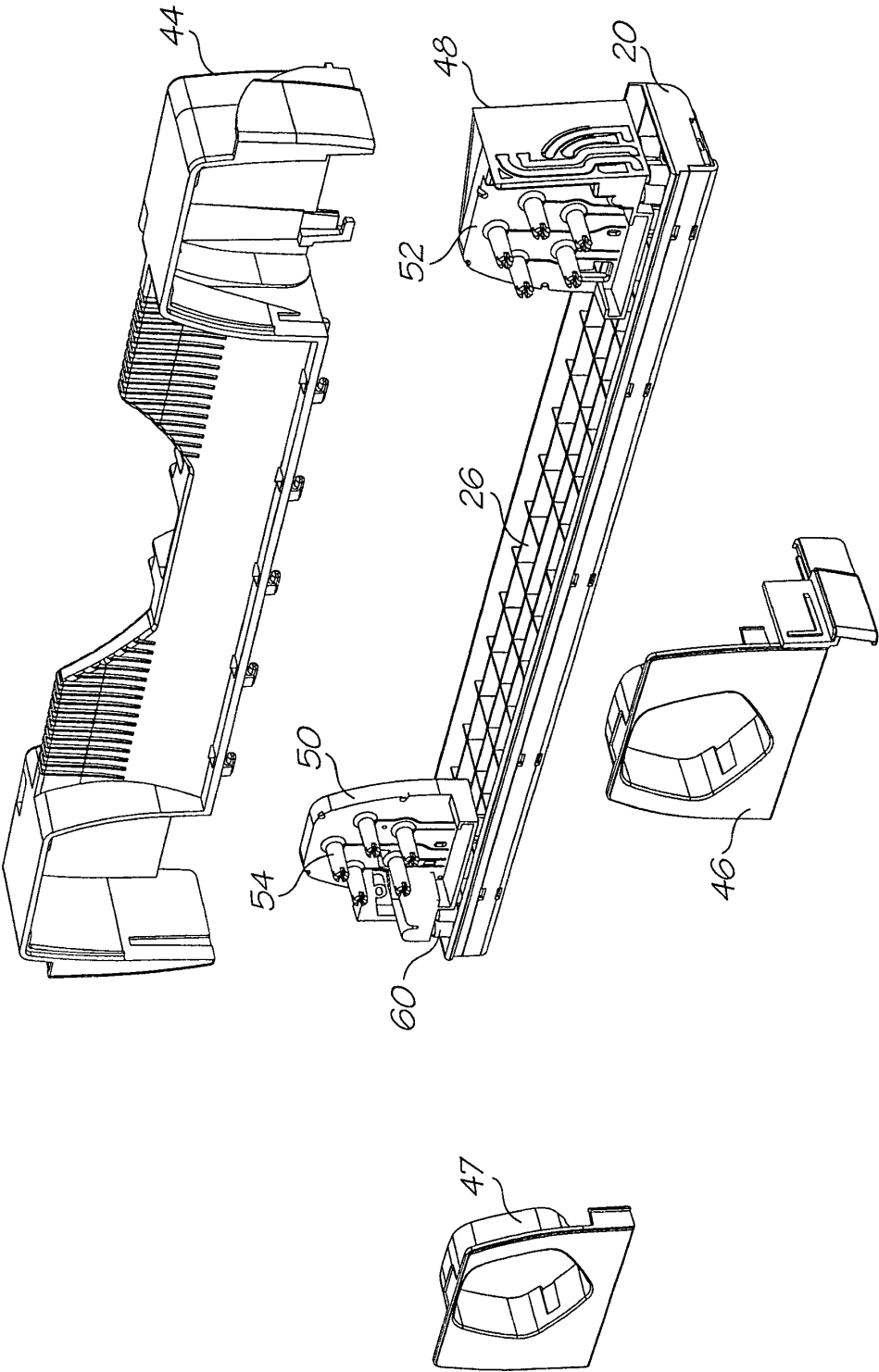


FIG. 5

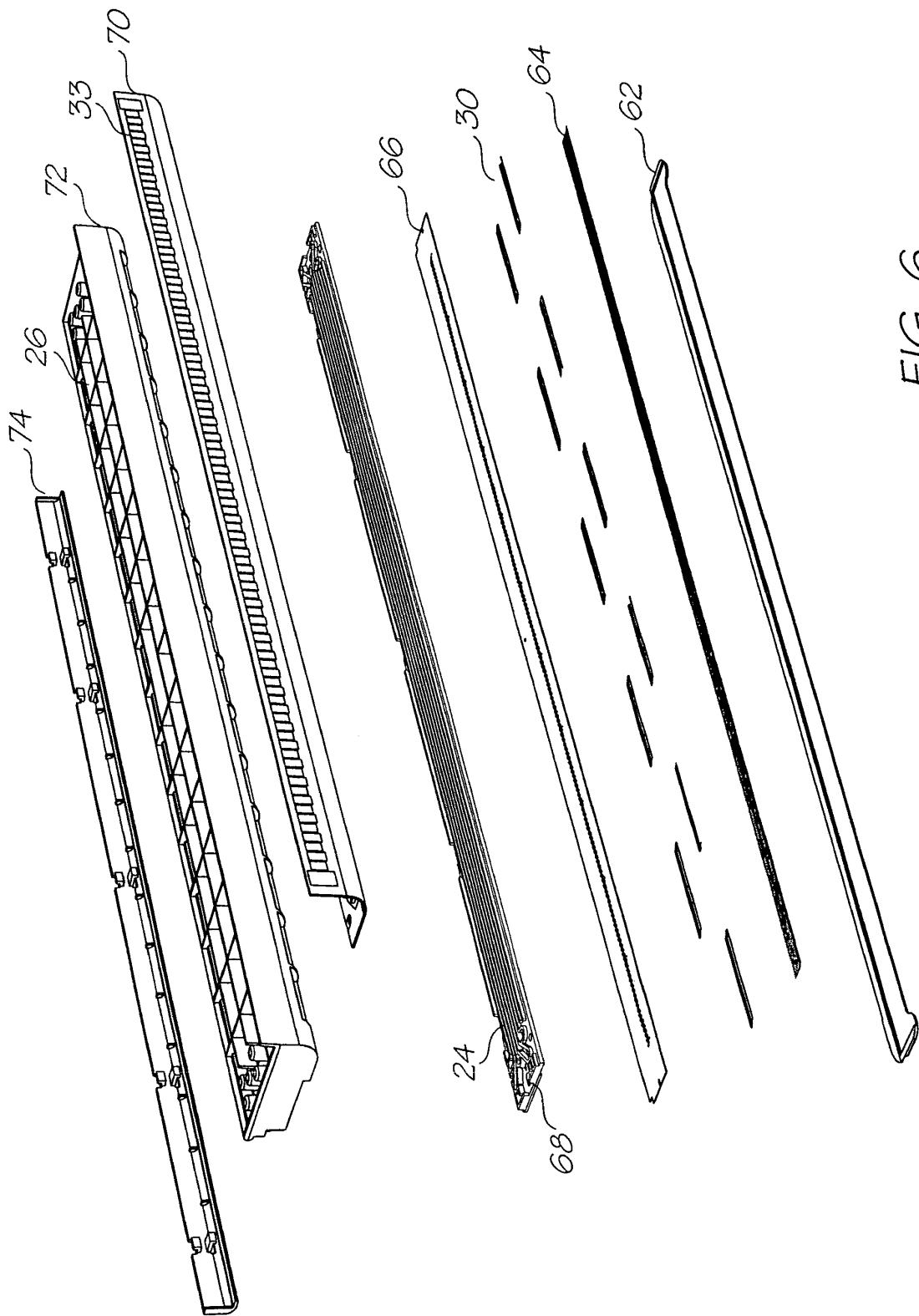
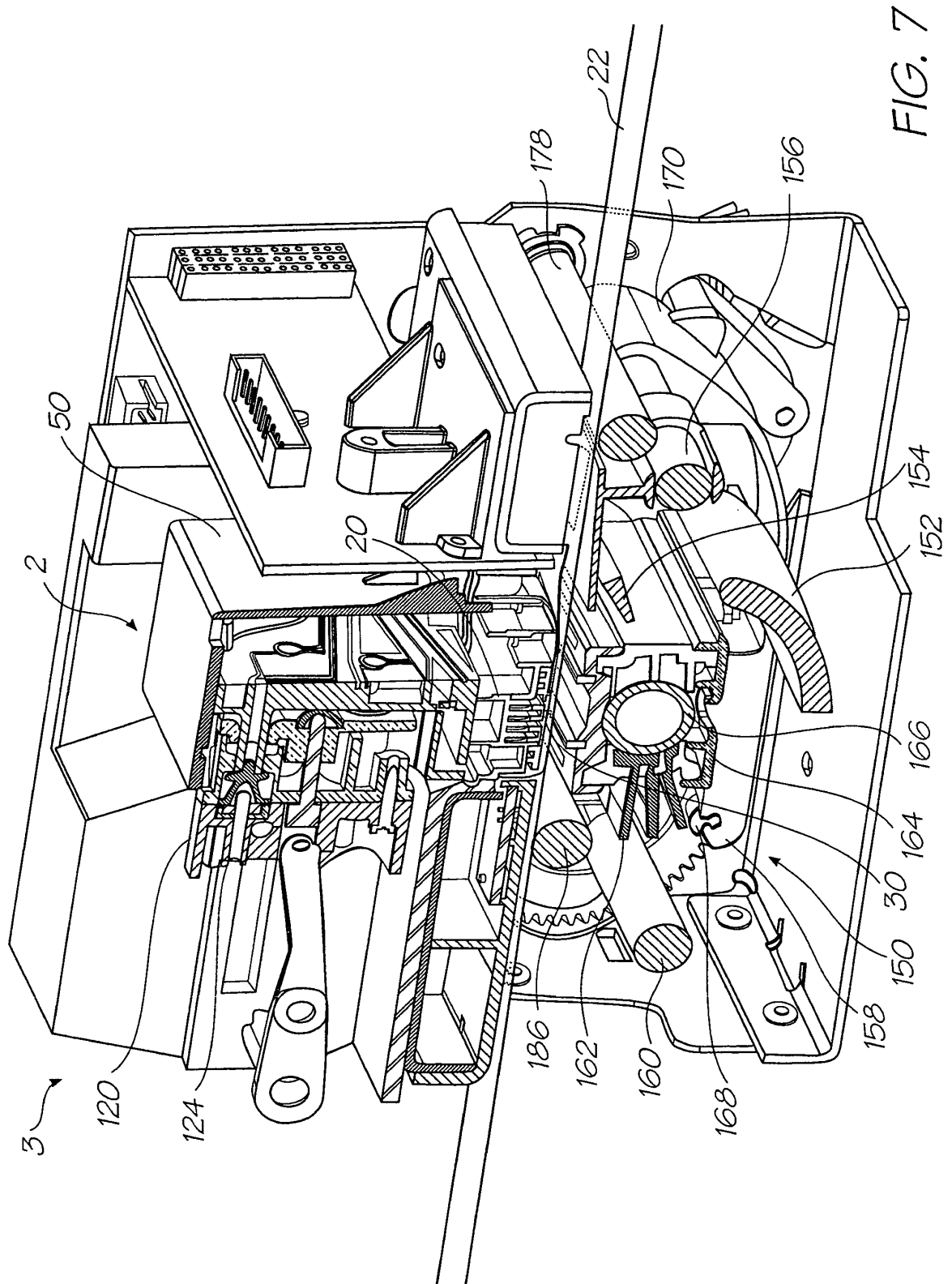
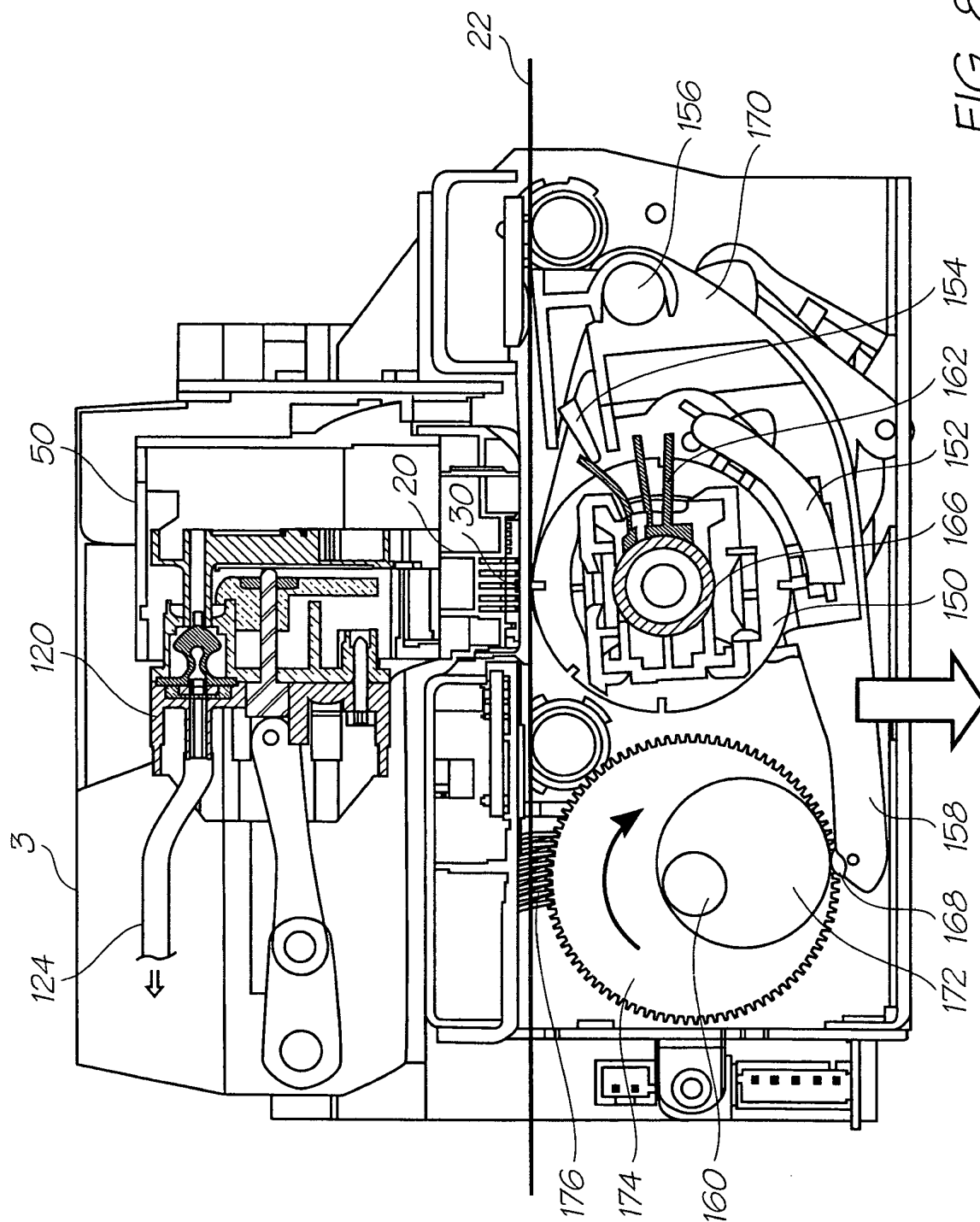


FIG. 6





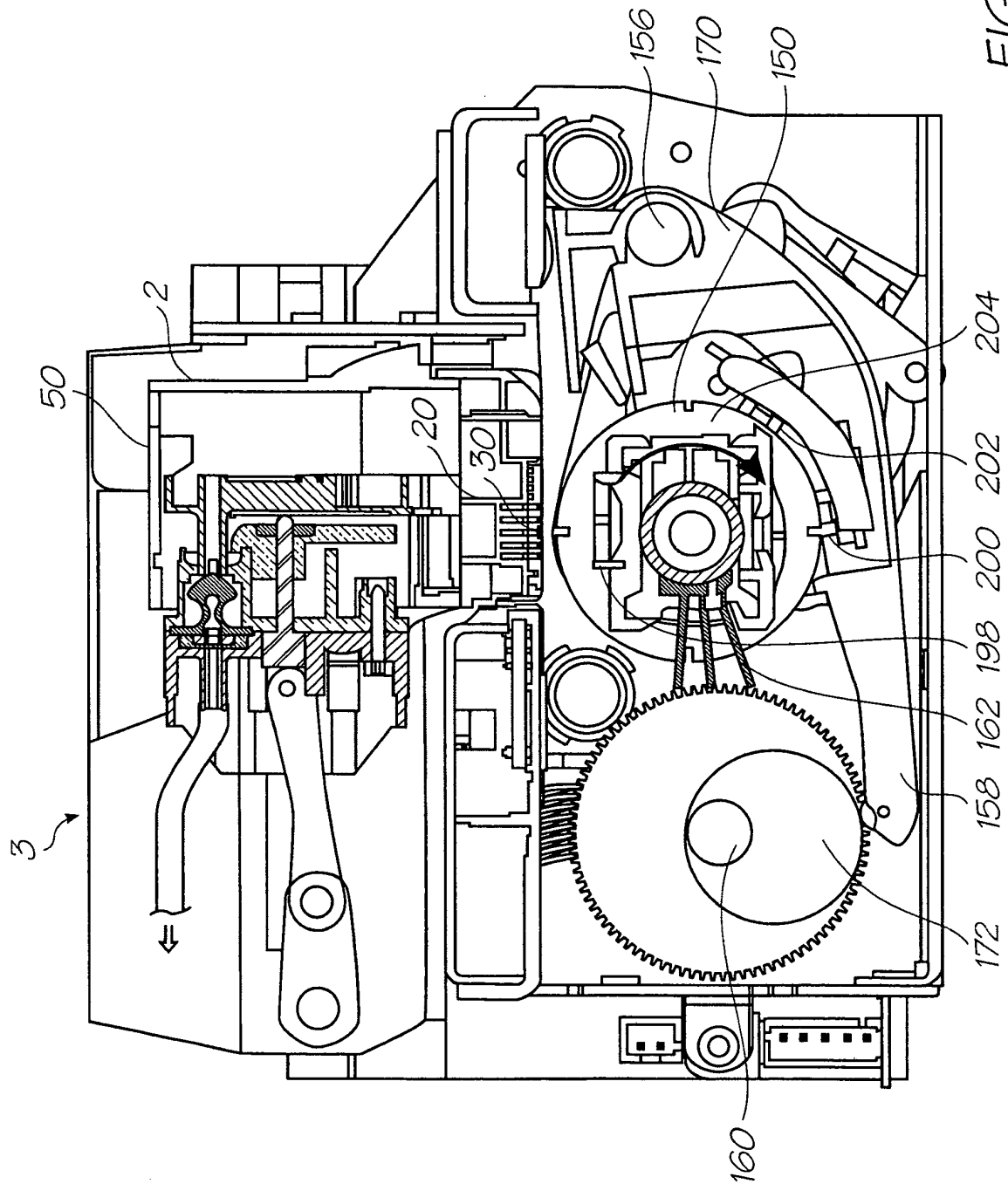


FIG. 9

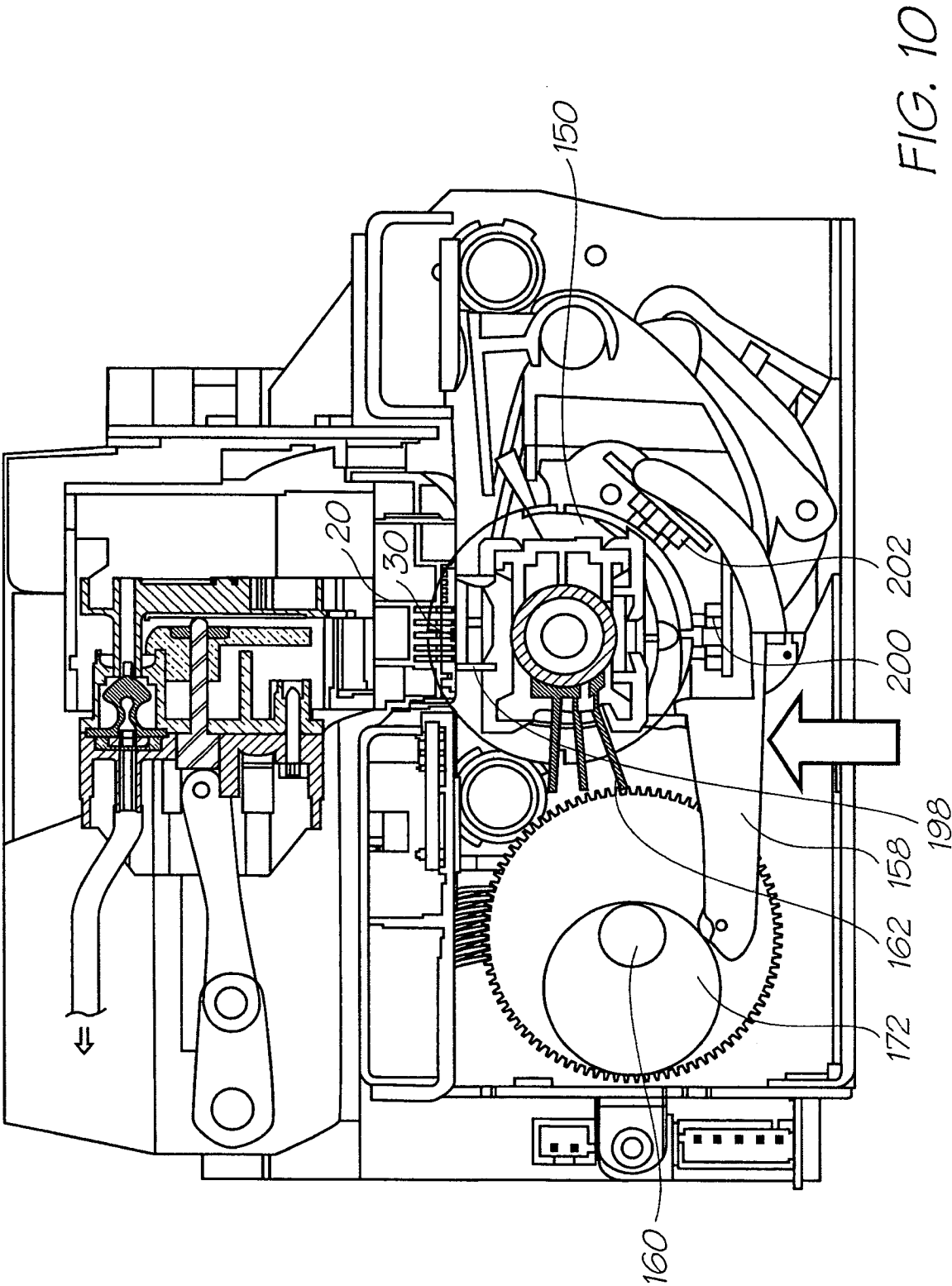


FIG. 10

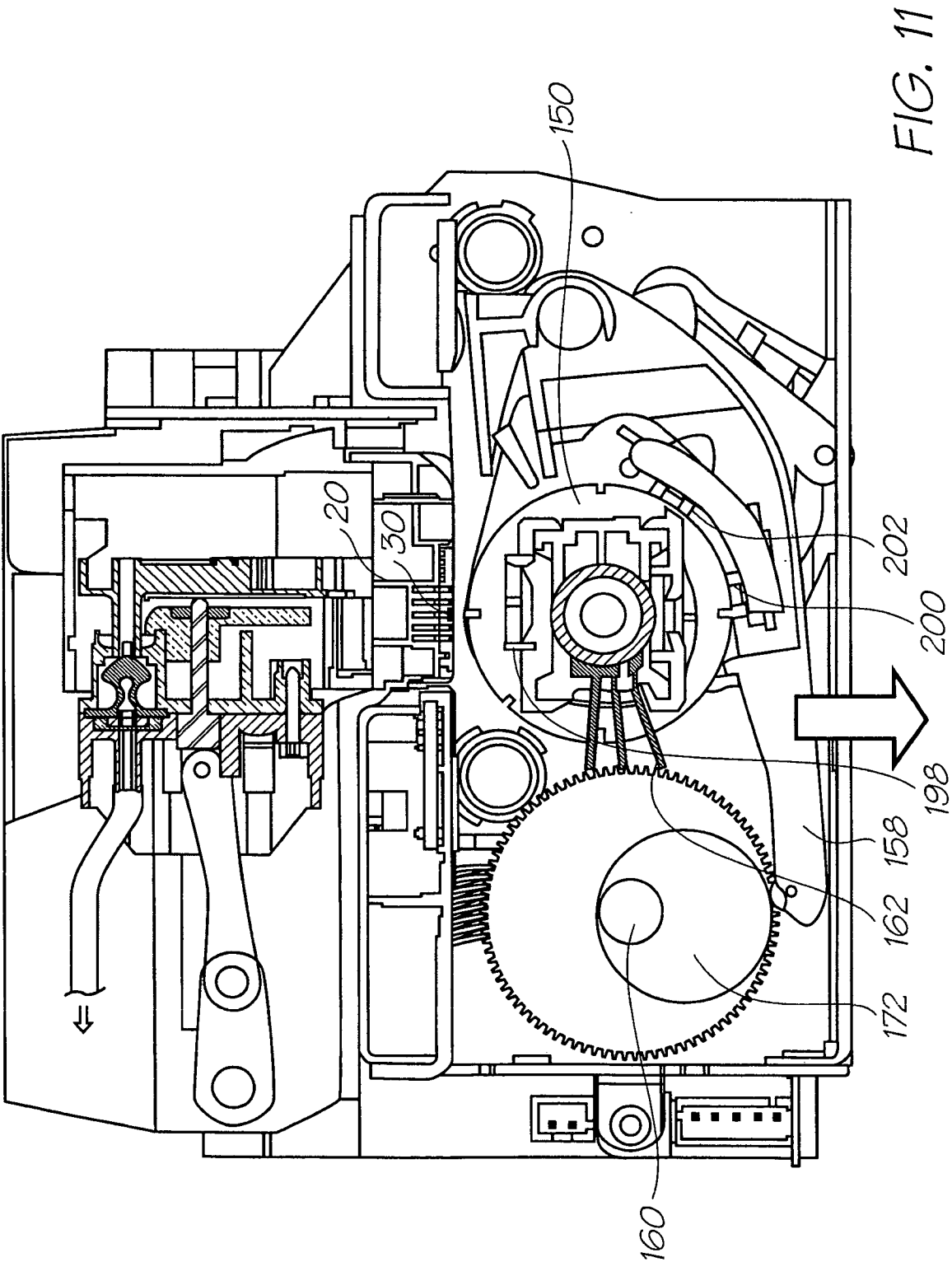
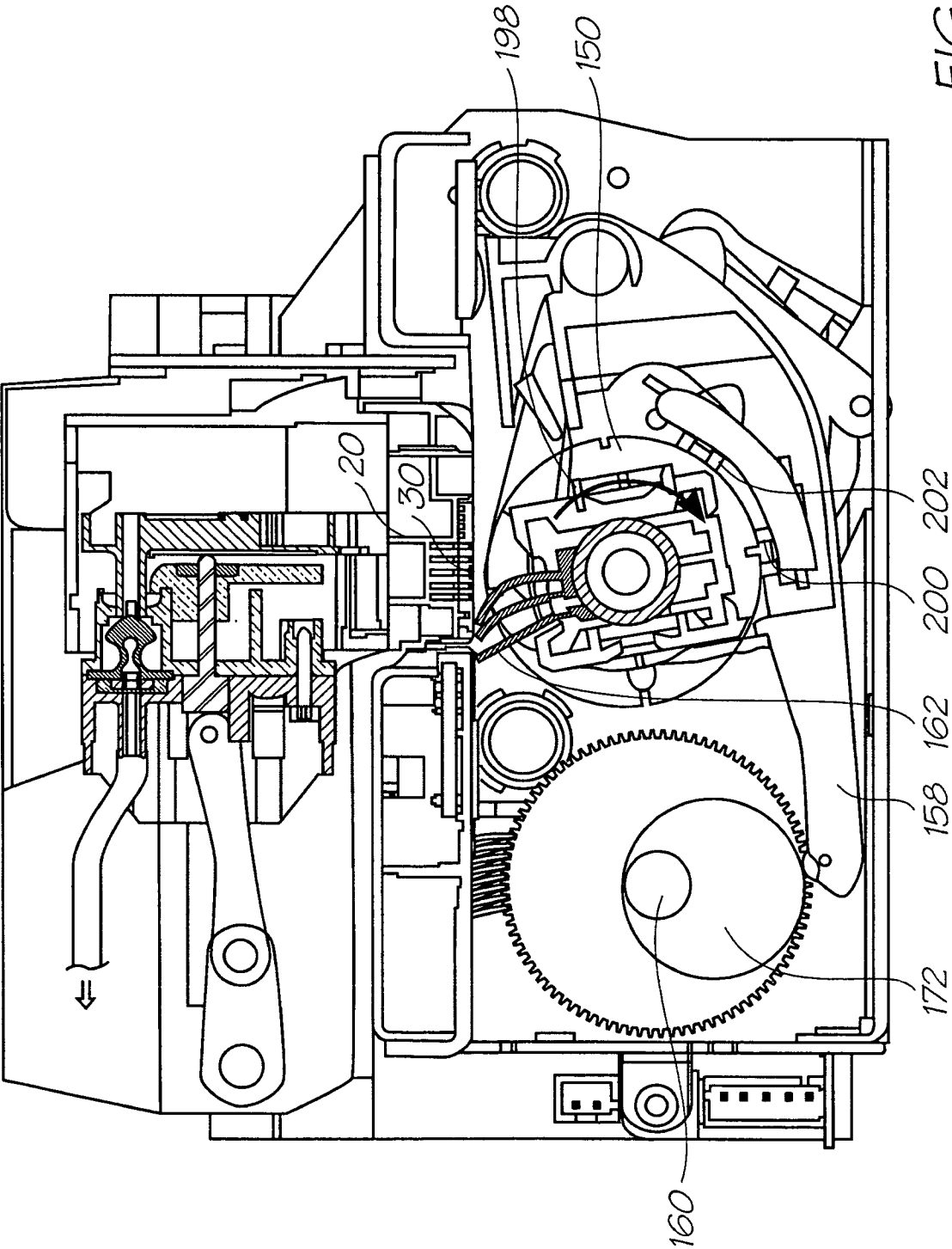


FIG. 11



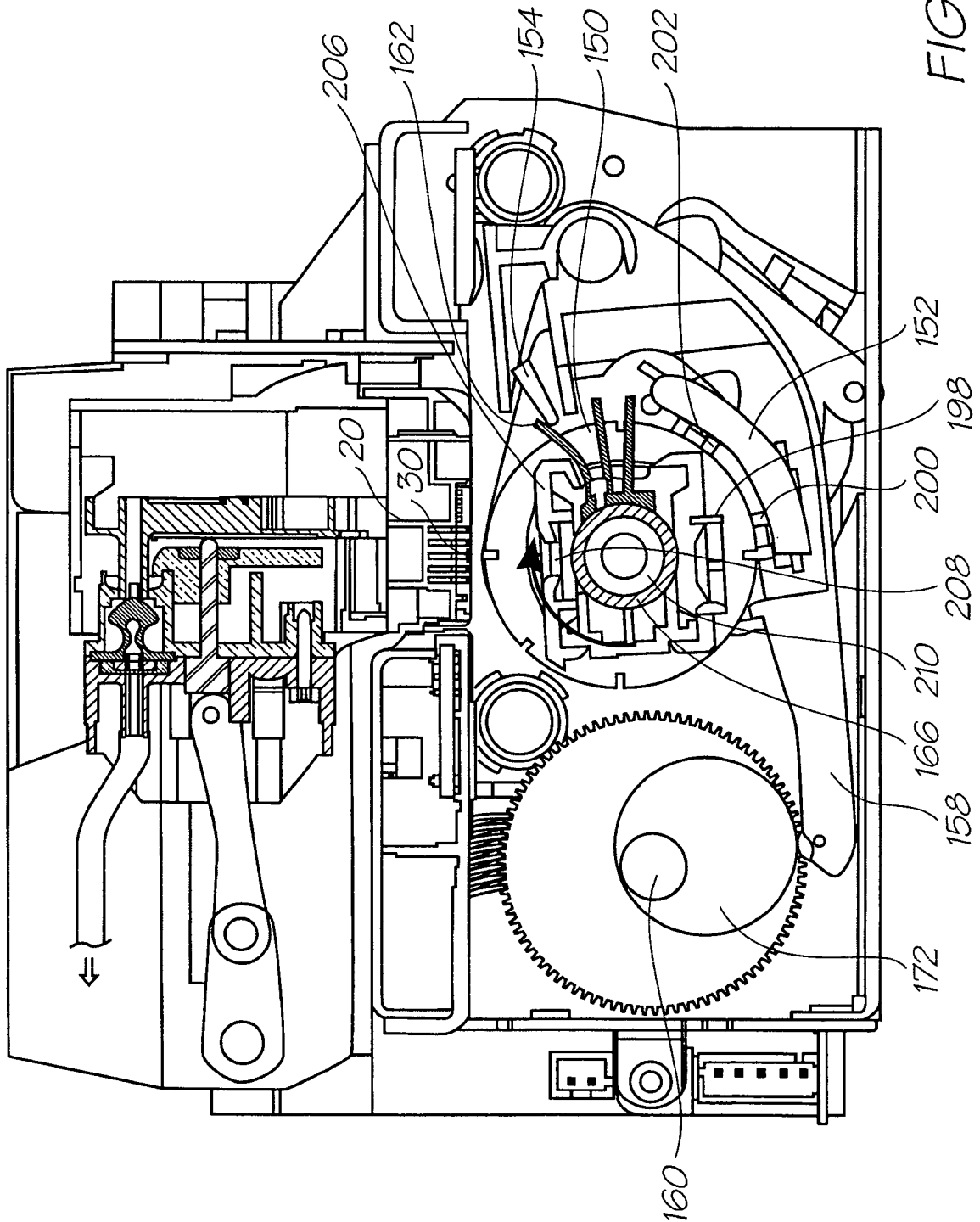
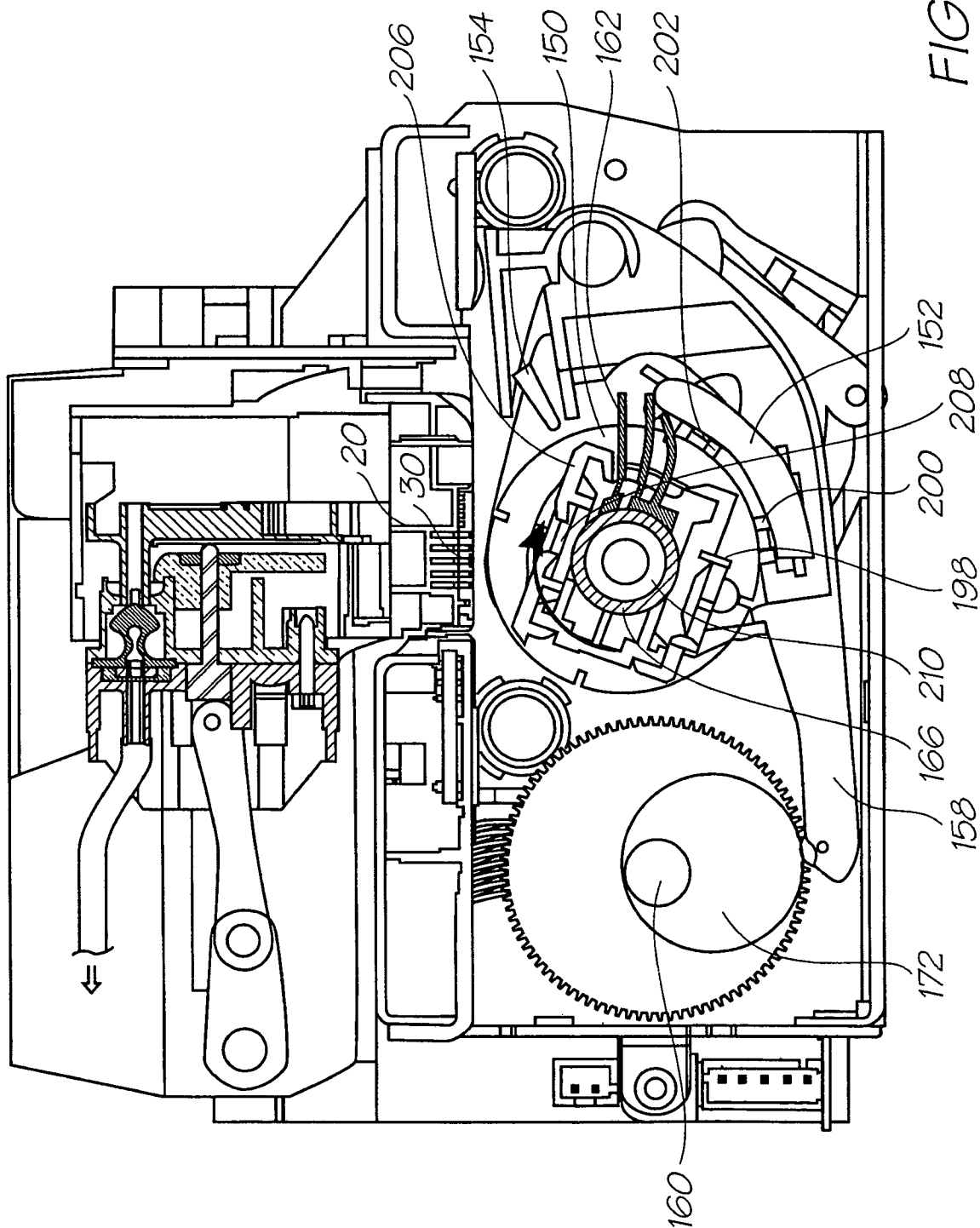
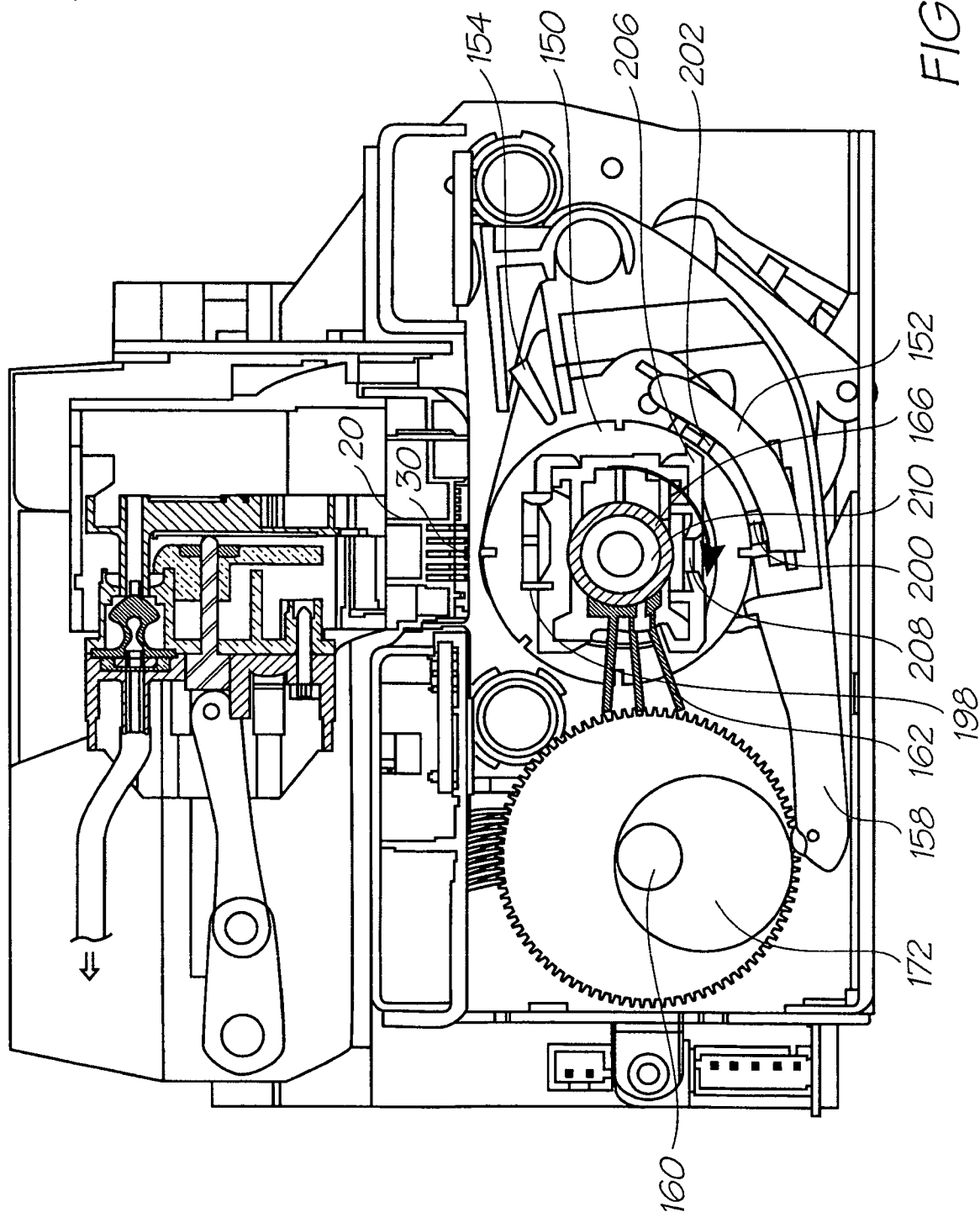


FIG. 13





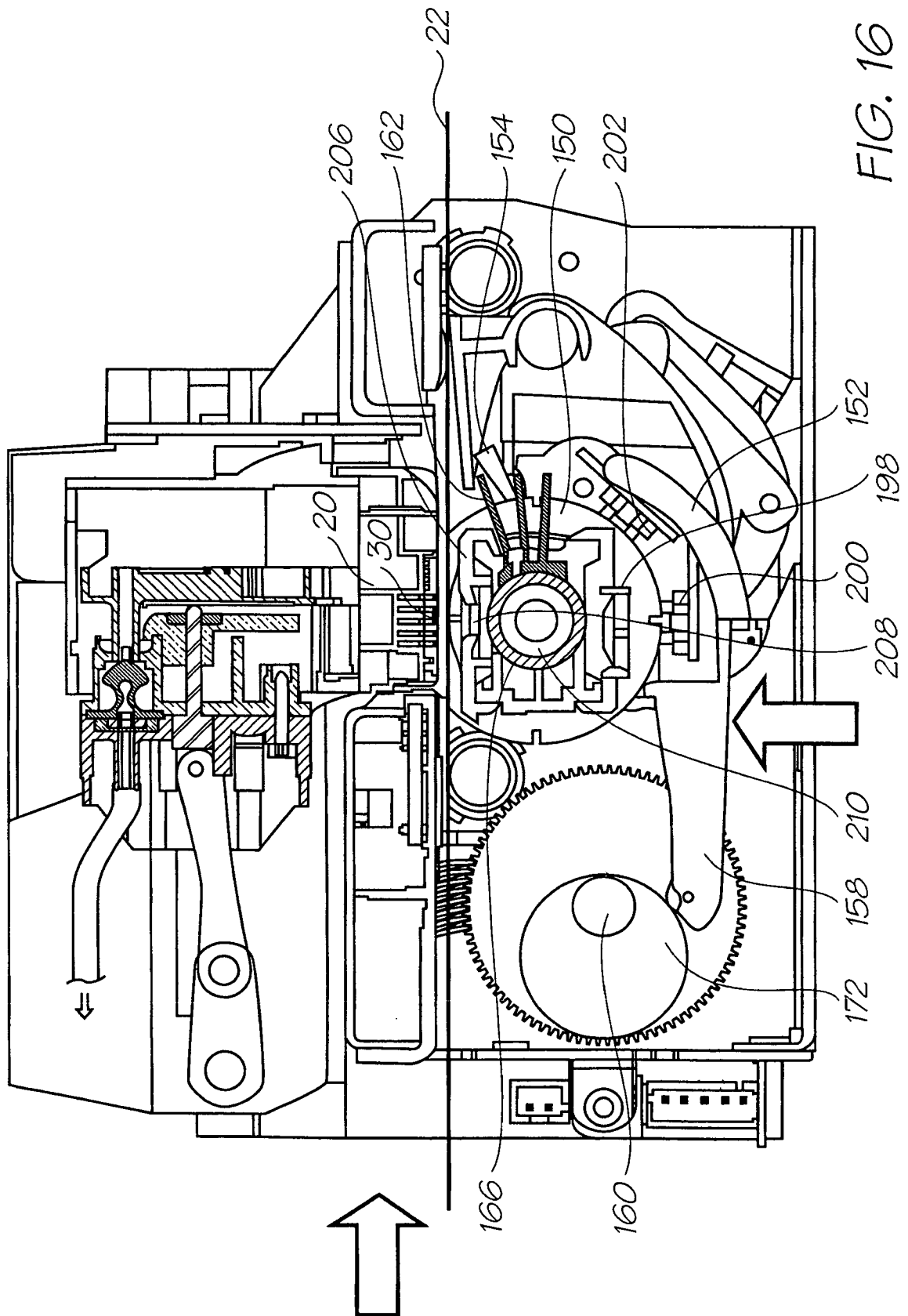


FIG. 16

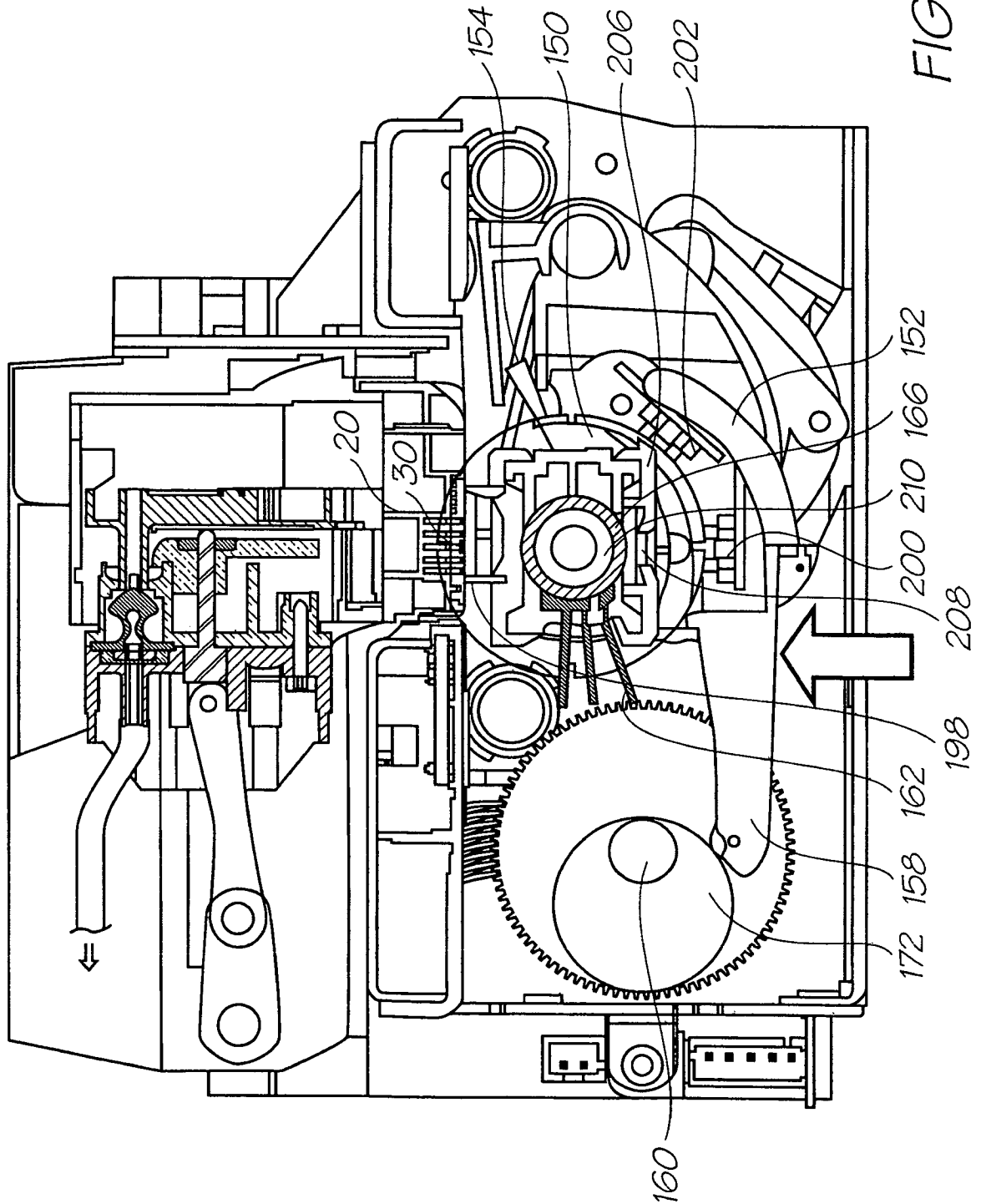


FIG. 17

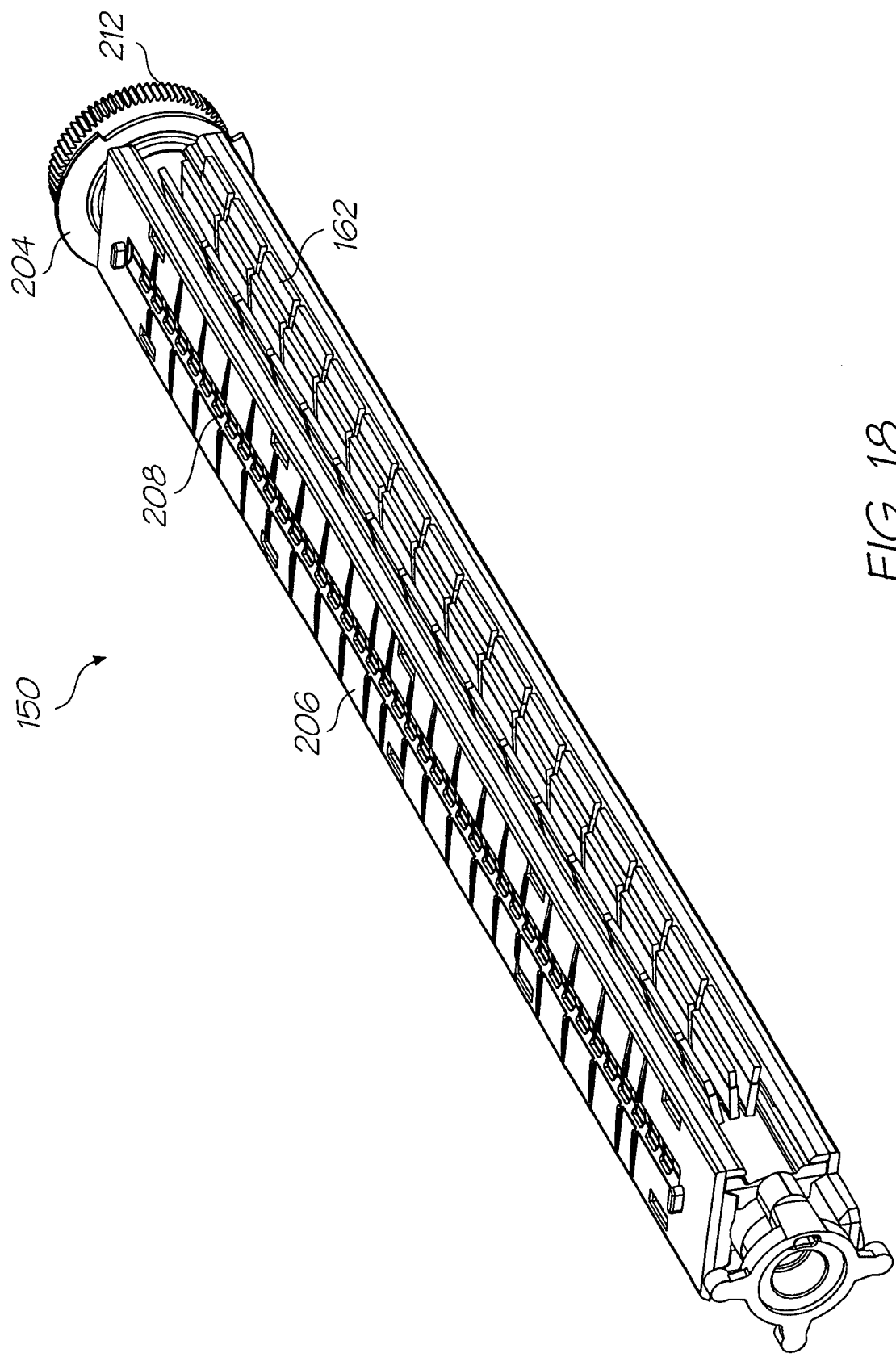


FIG. 18

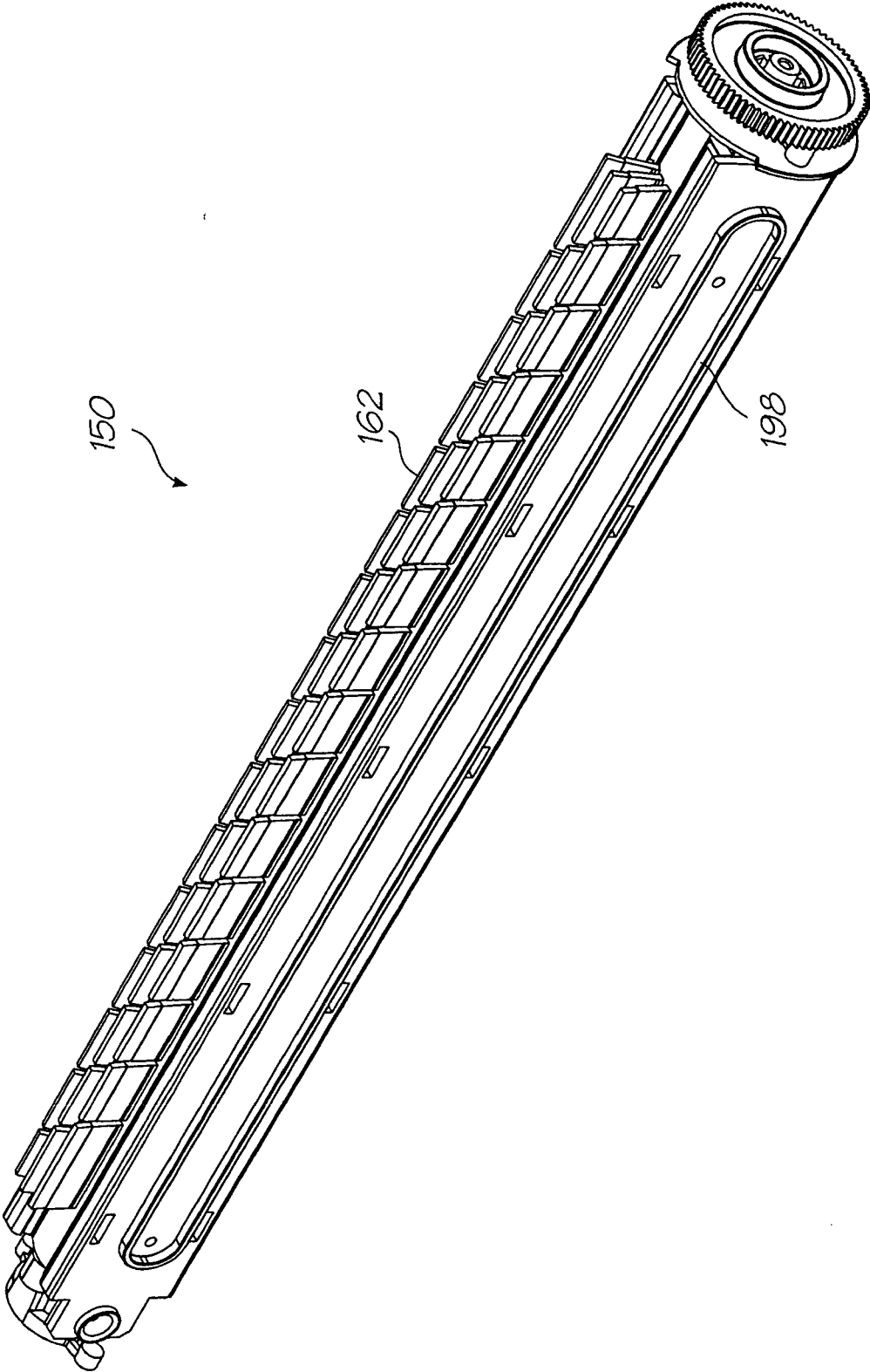


FIG. 19

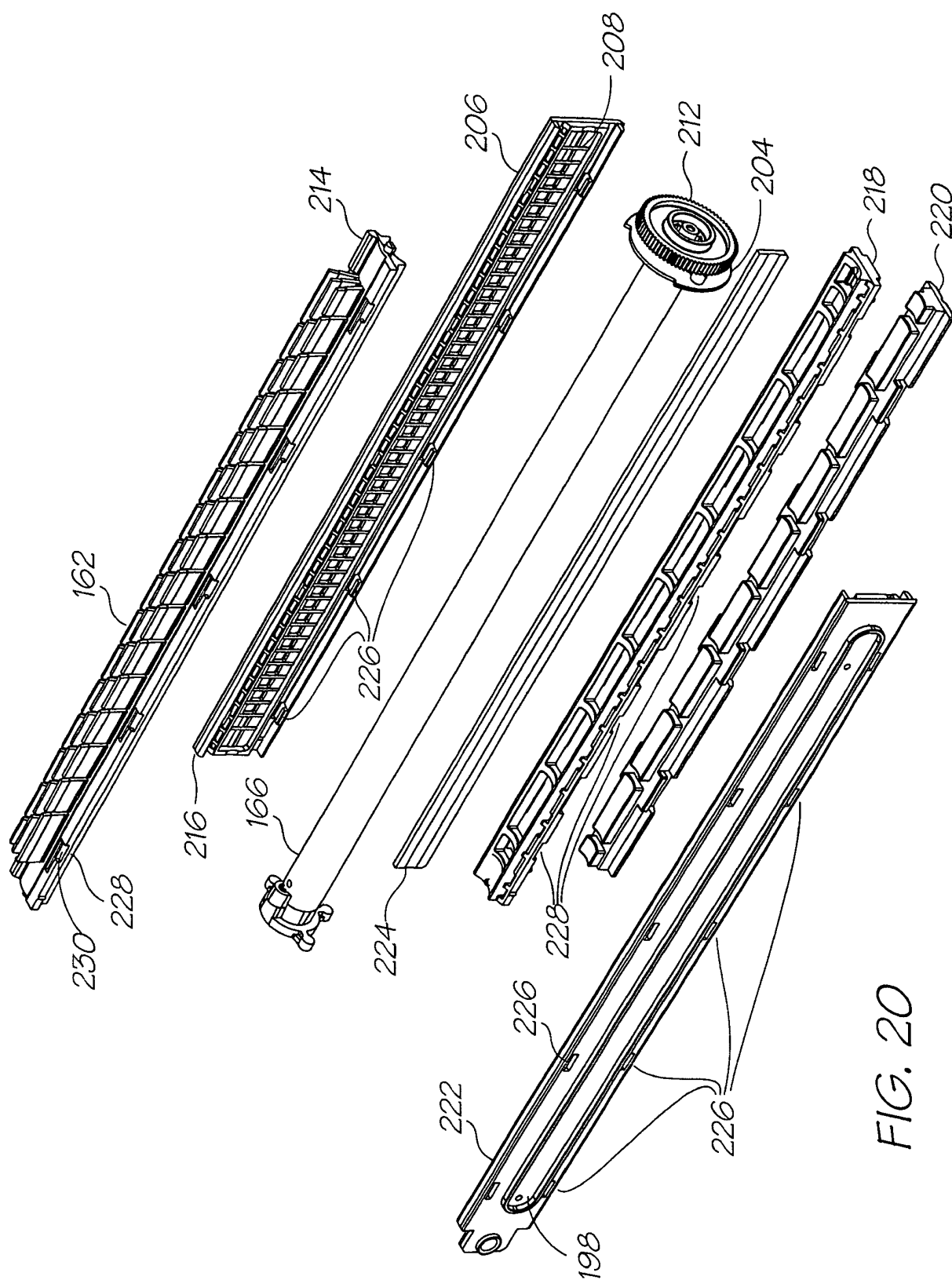


FIG. 20

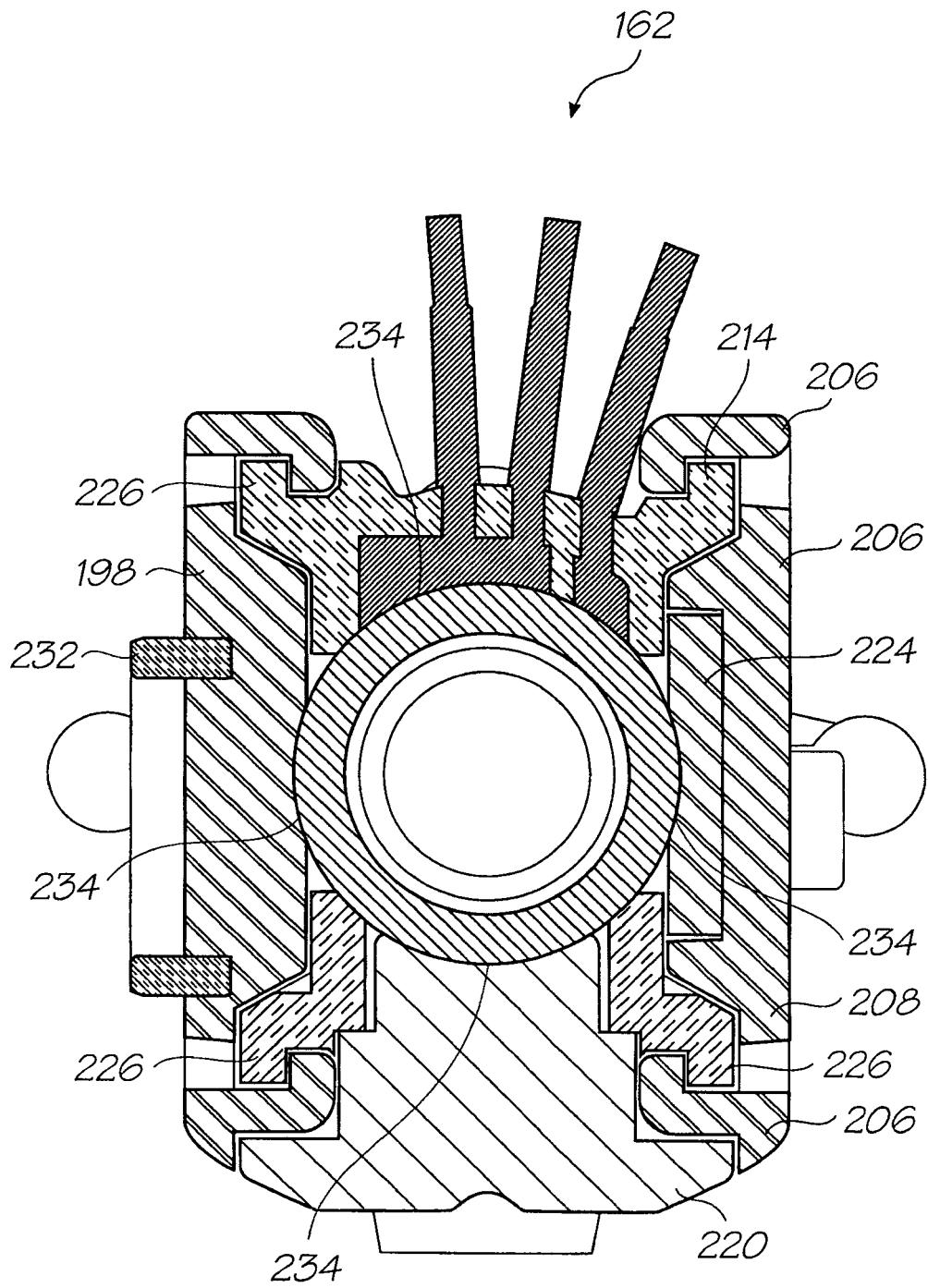


FIG. 21

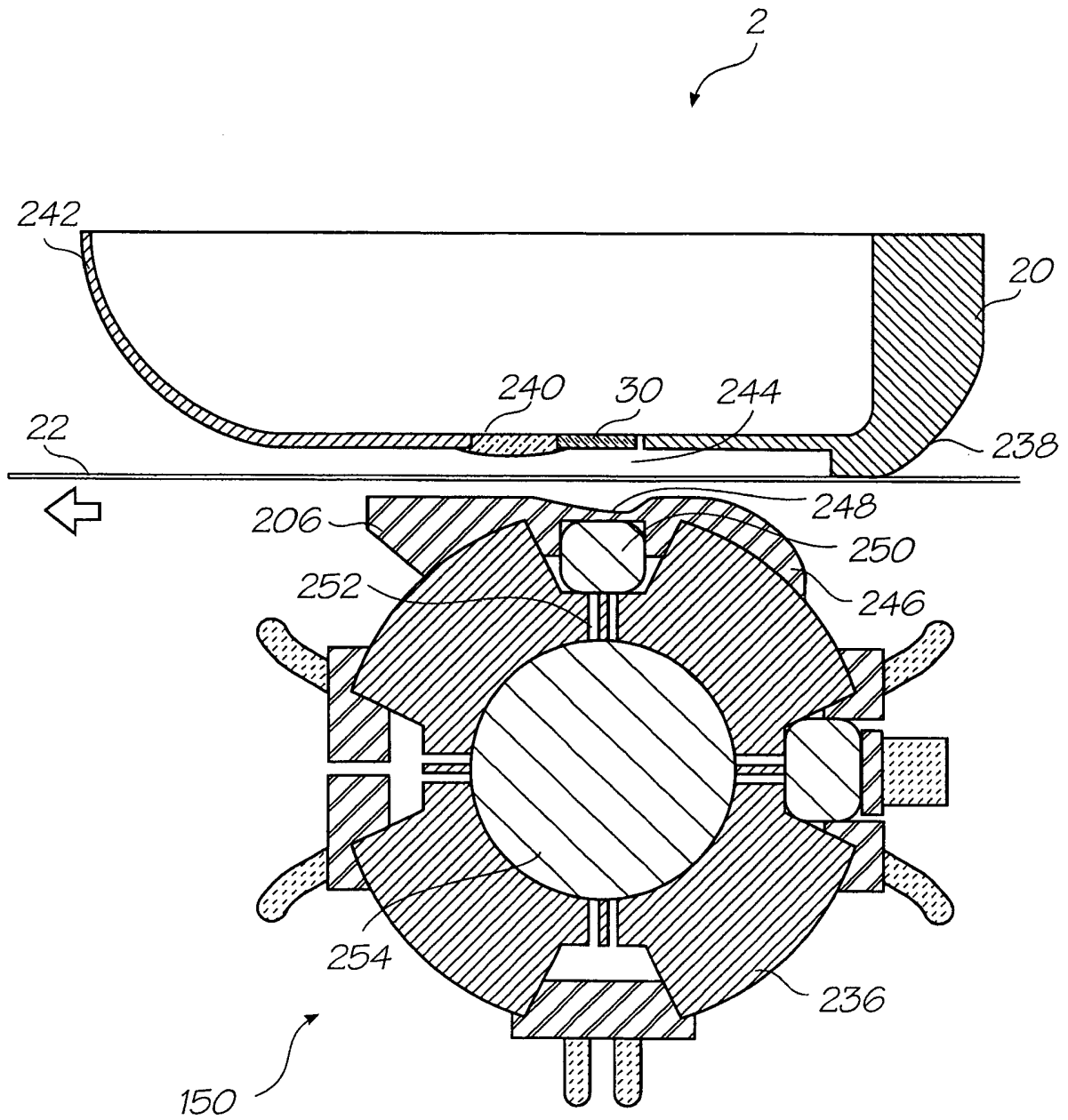


FIG. 22

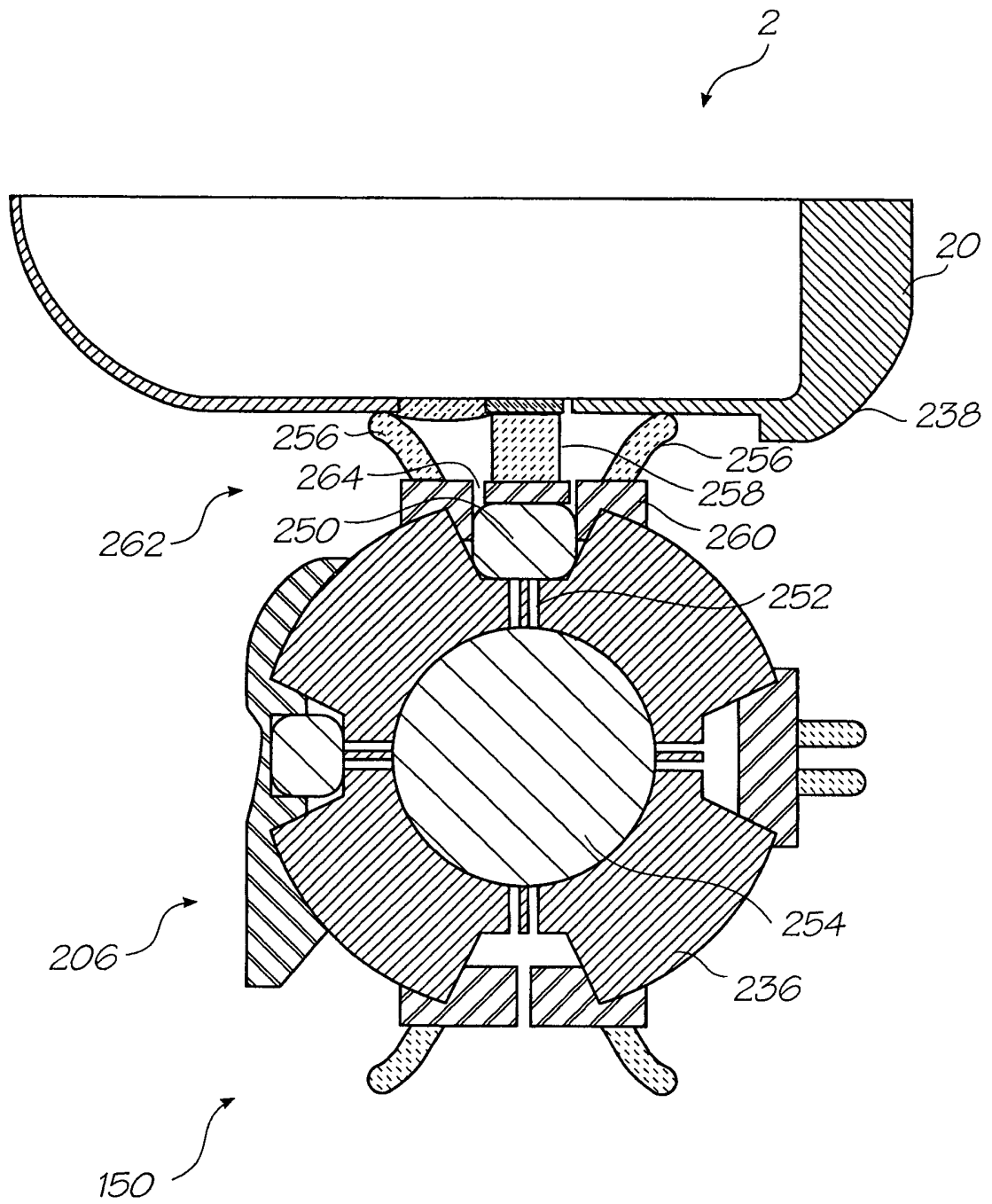


FIG. 23

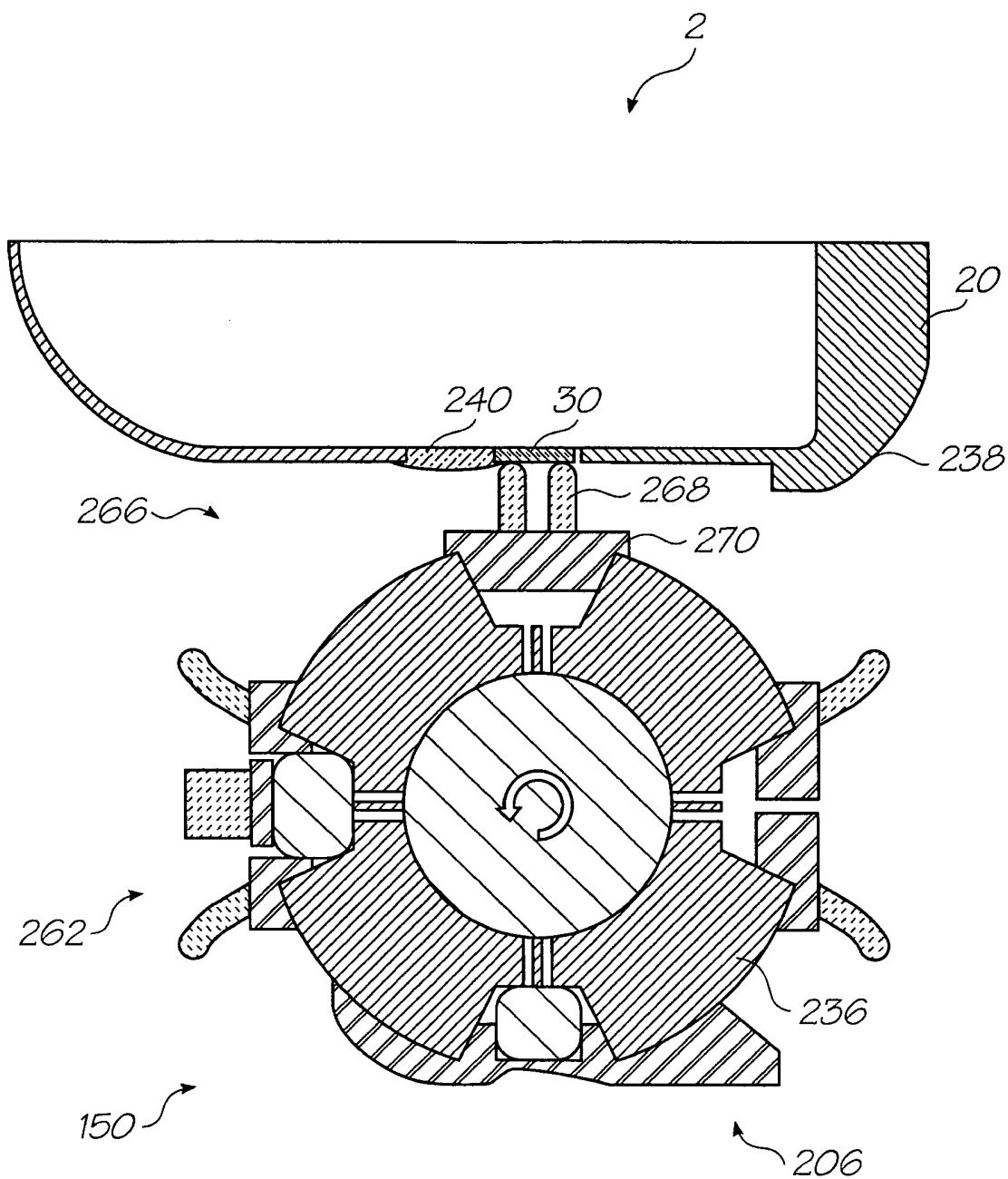


FIG. 24

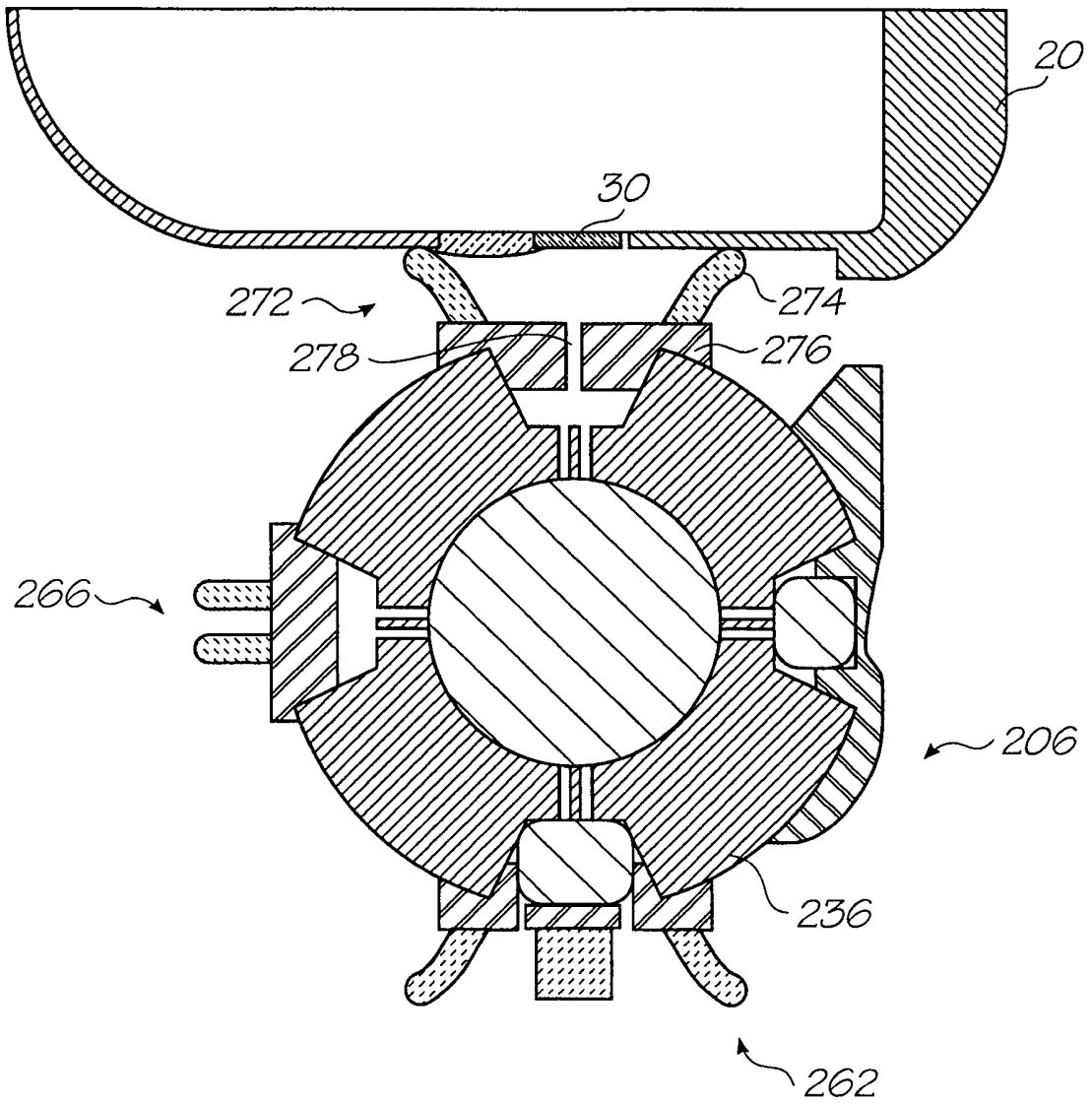


FIG. 25

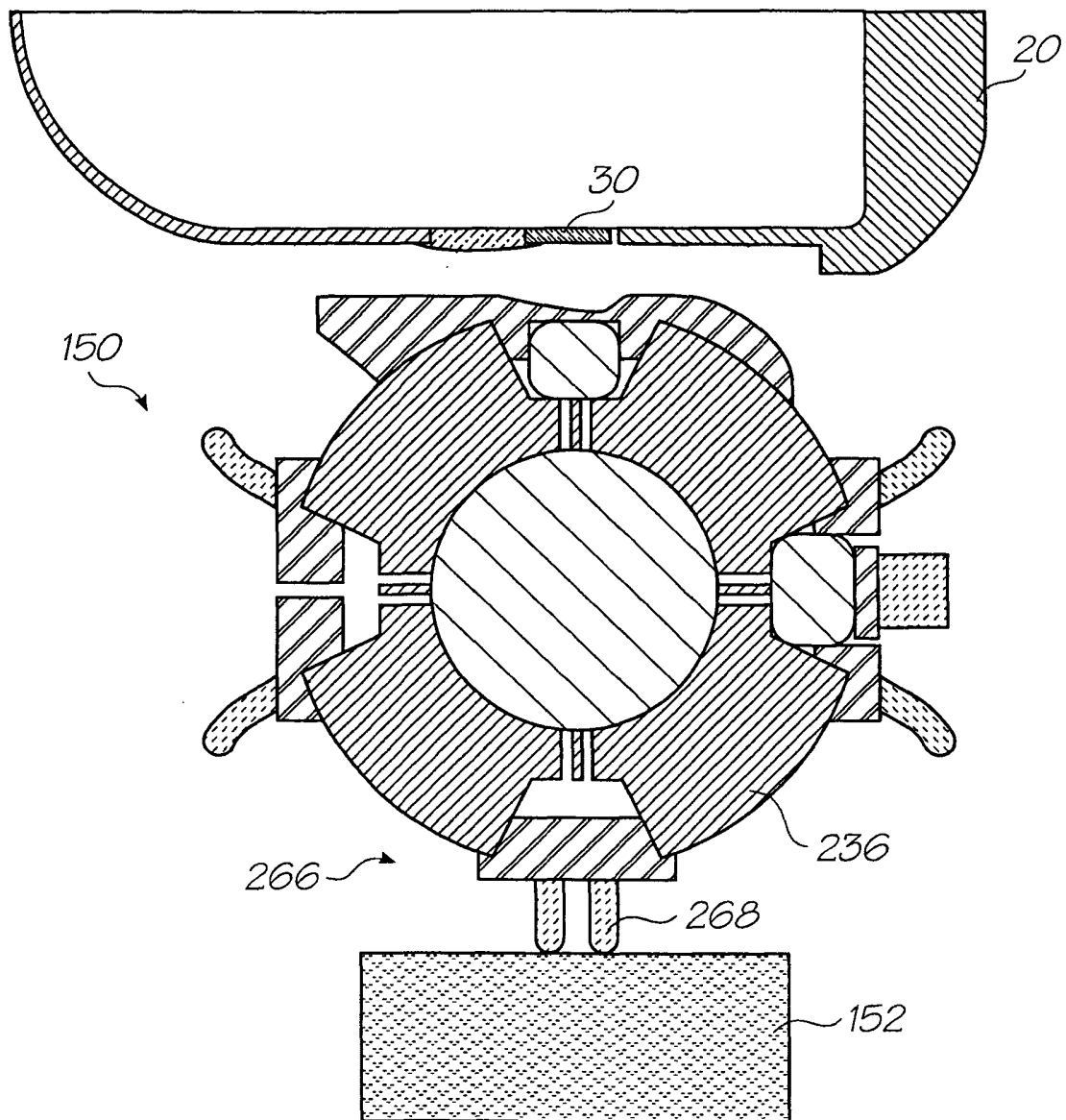


FIG. 26

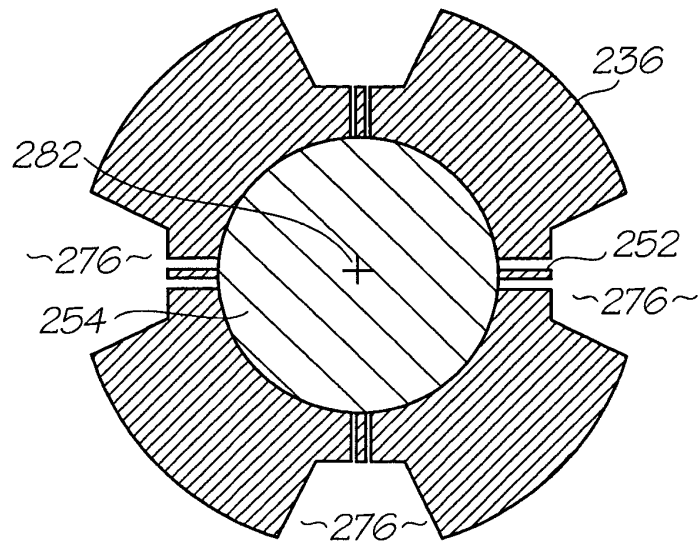


FIG. 27

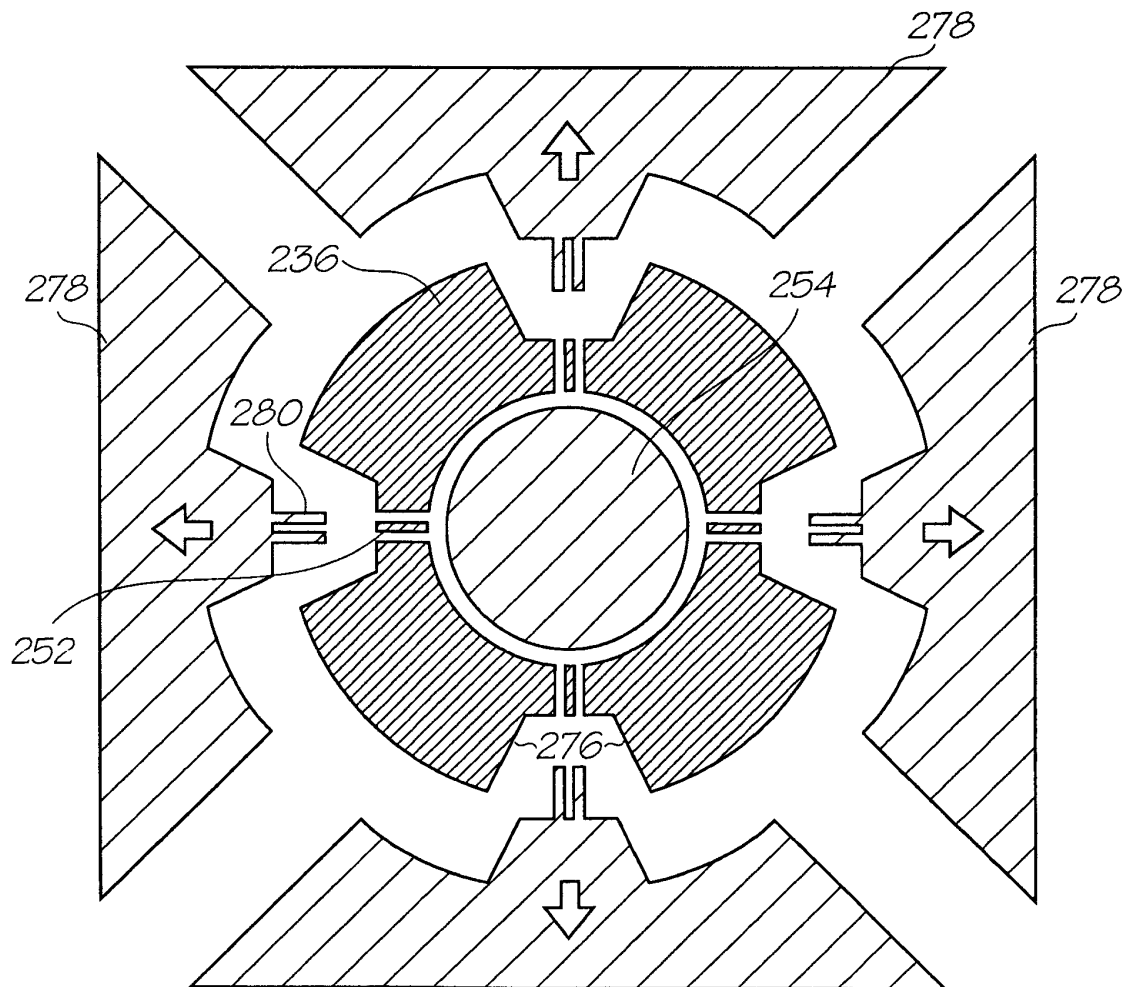


FIG. 28

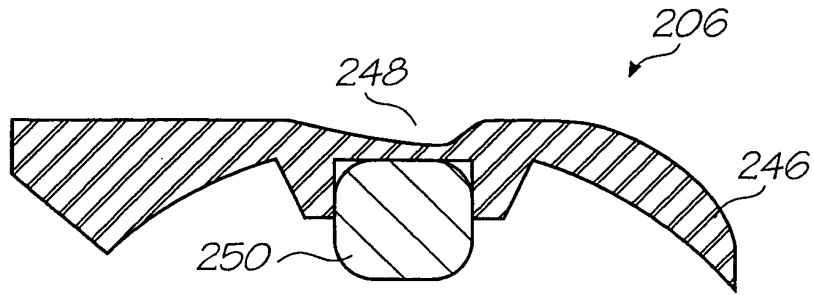


FIG. 29

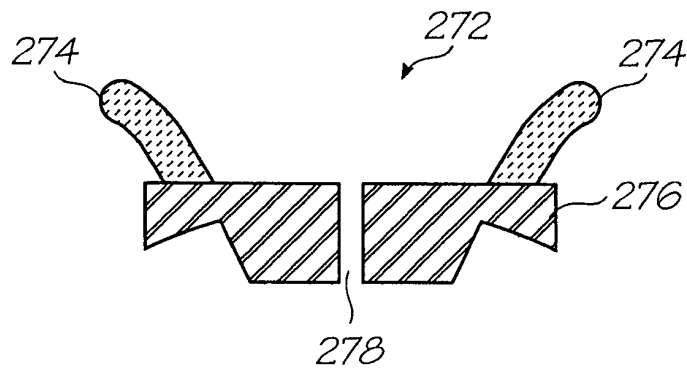


FIG. 30

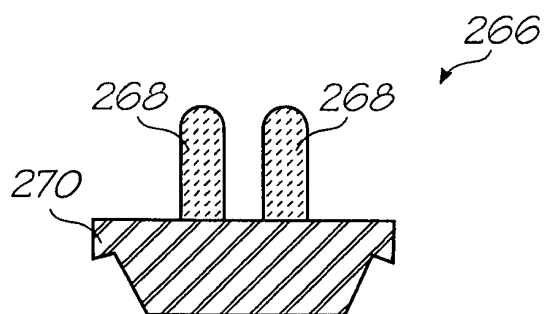


FIG. 31

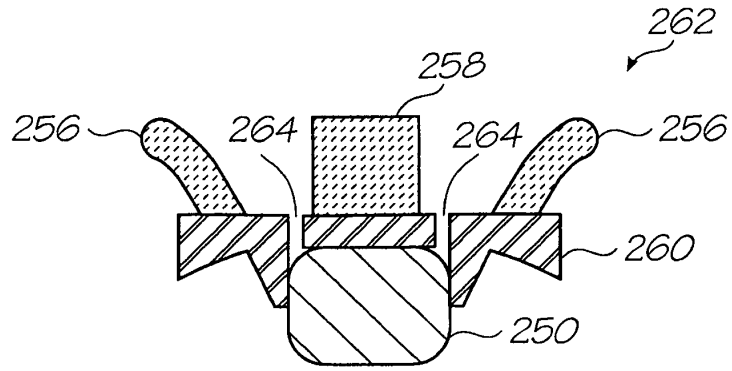


FIG. 32

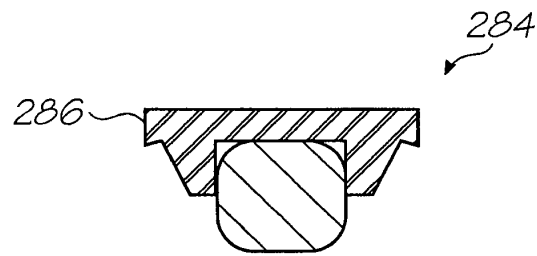


FIG. 33

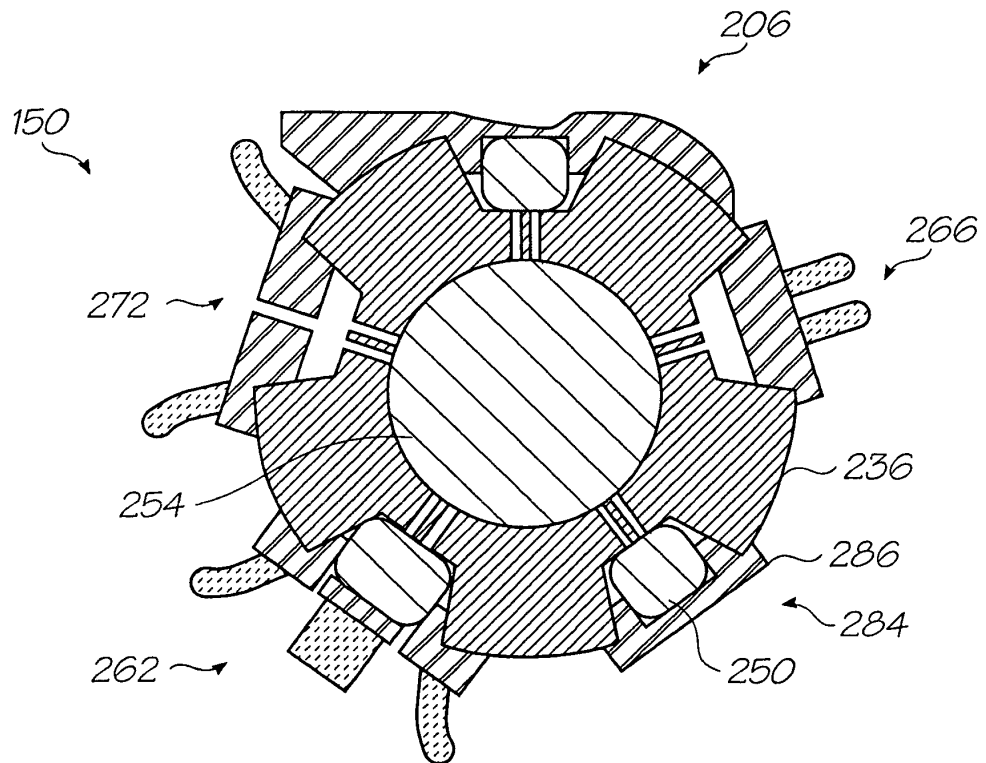
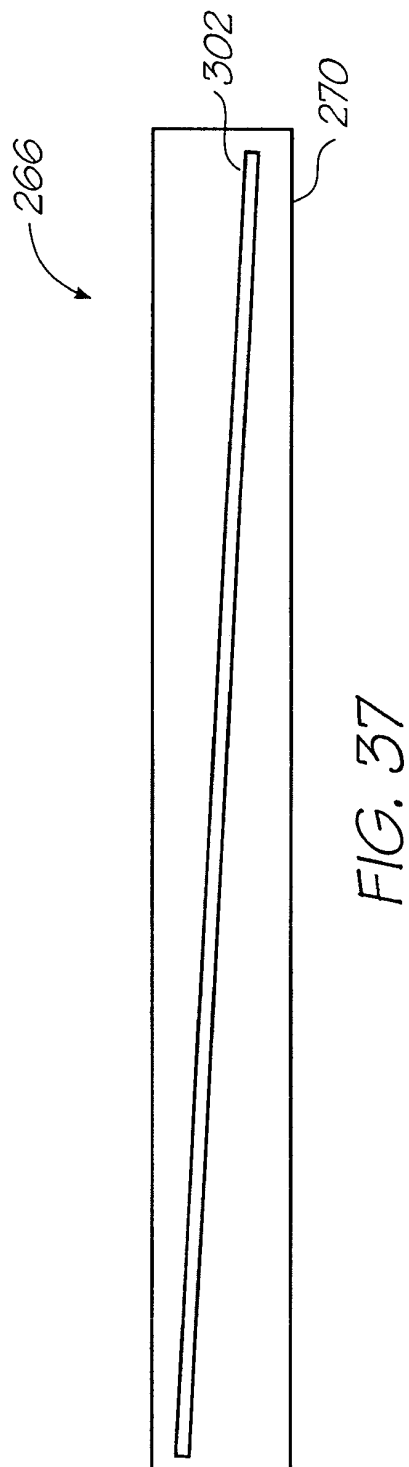
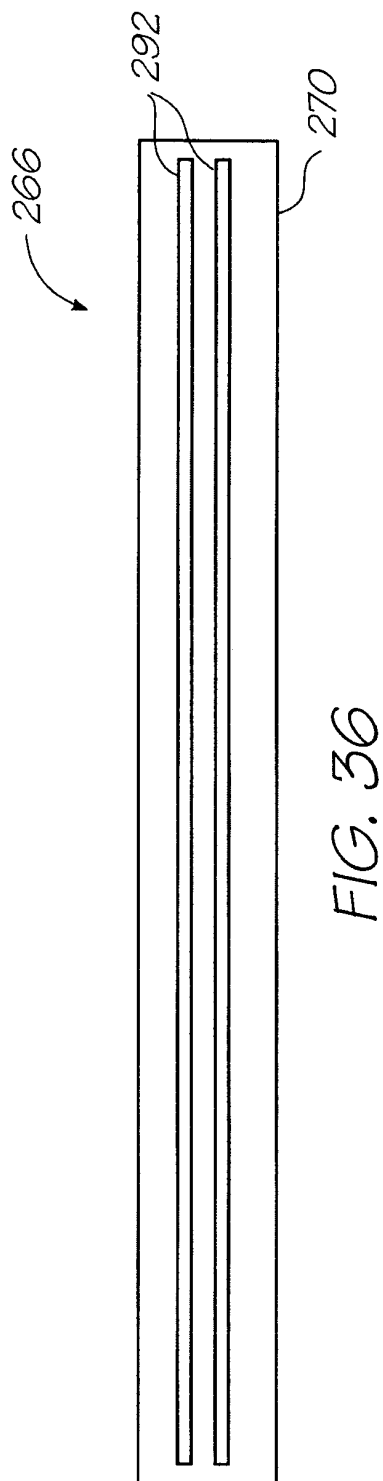
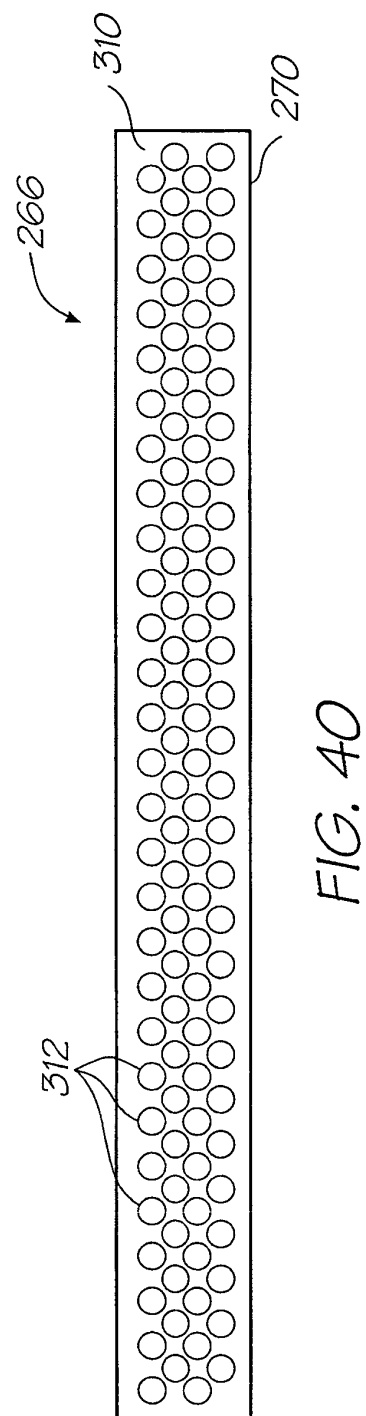
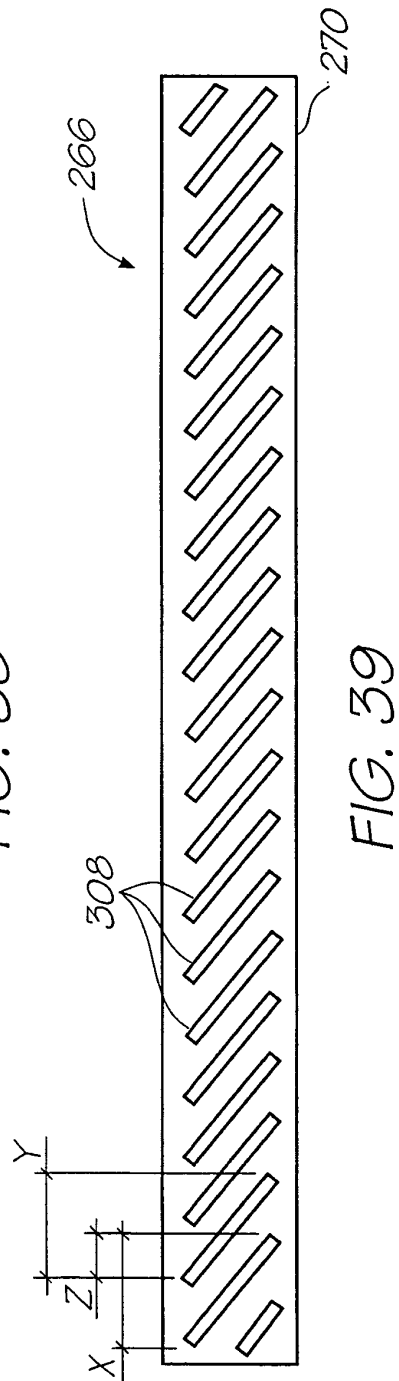
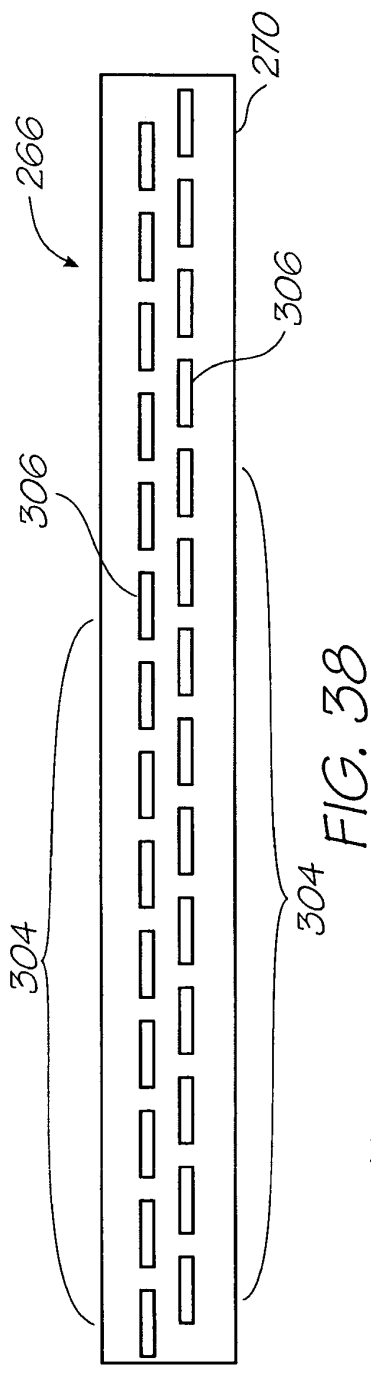
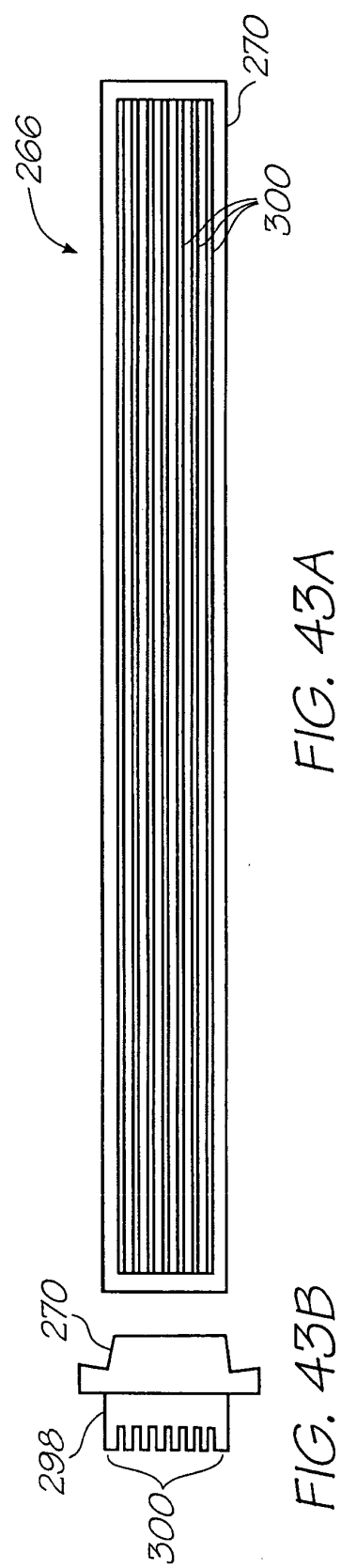
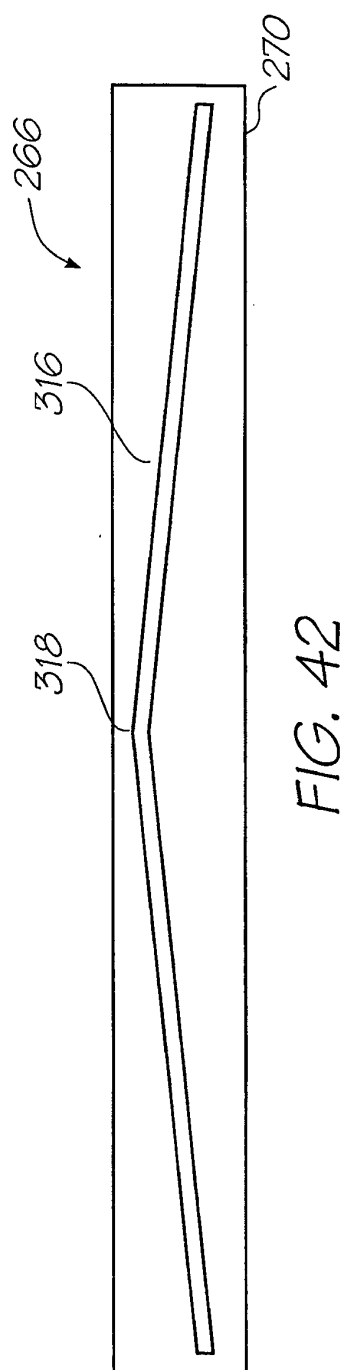
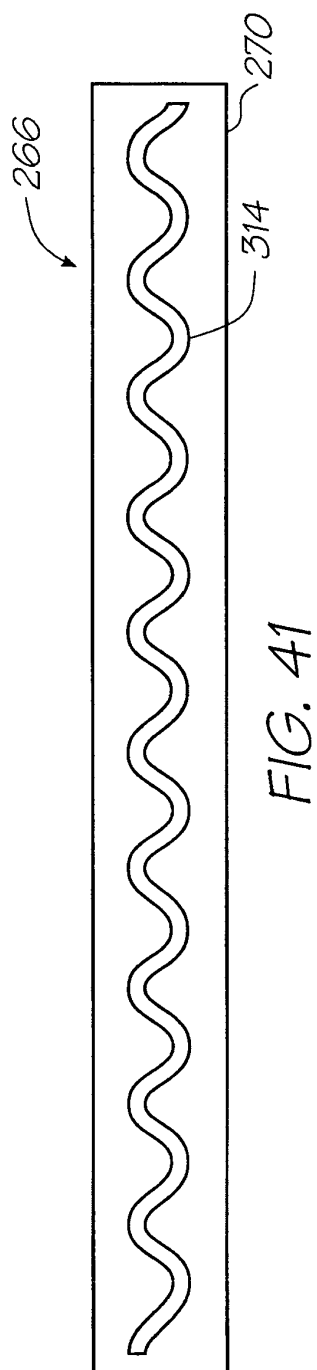
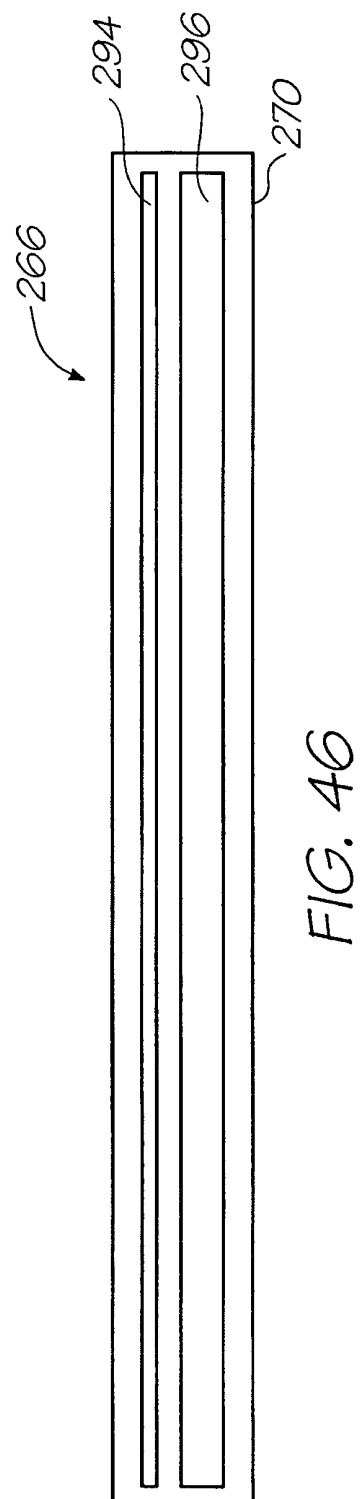
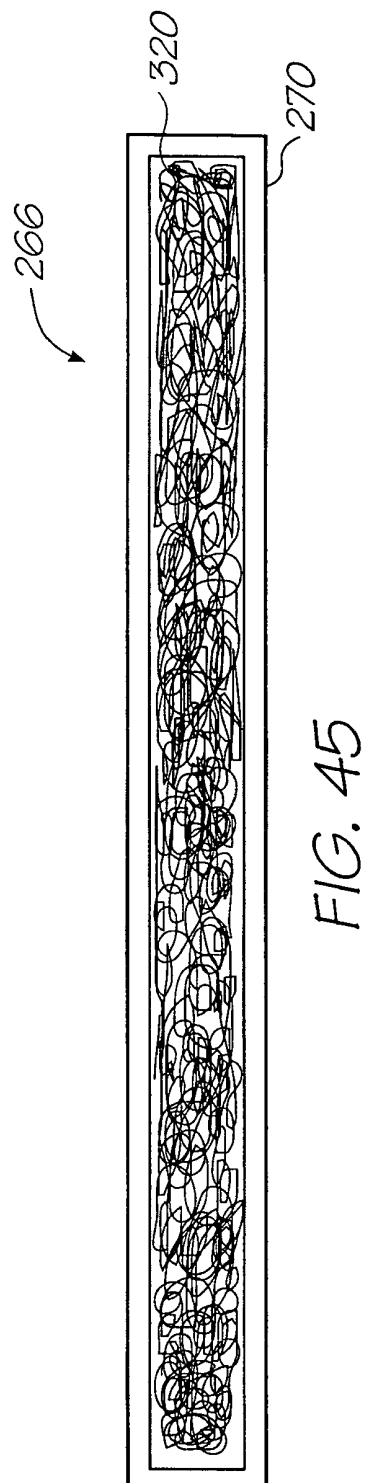
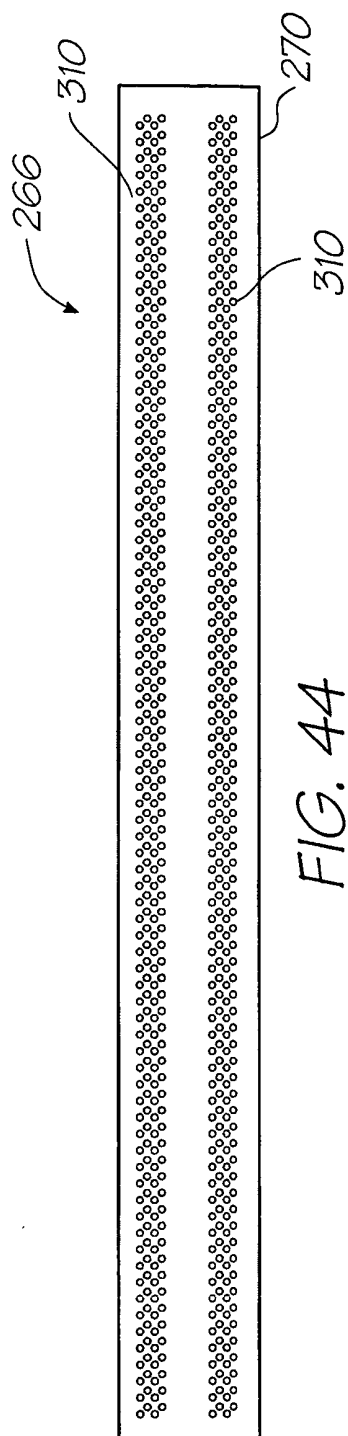


FIG. 34









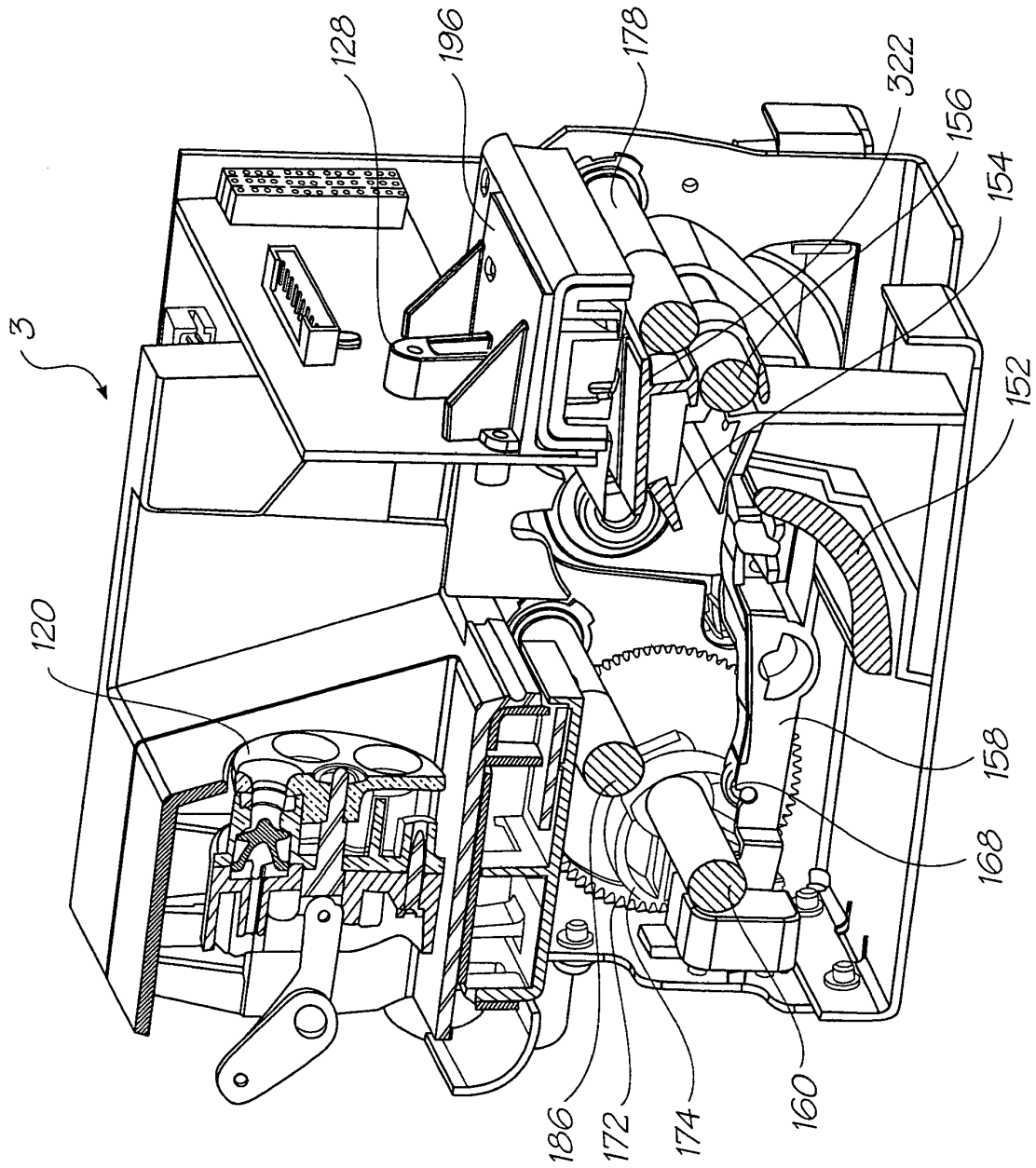
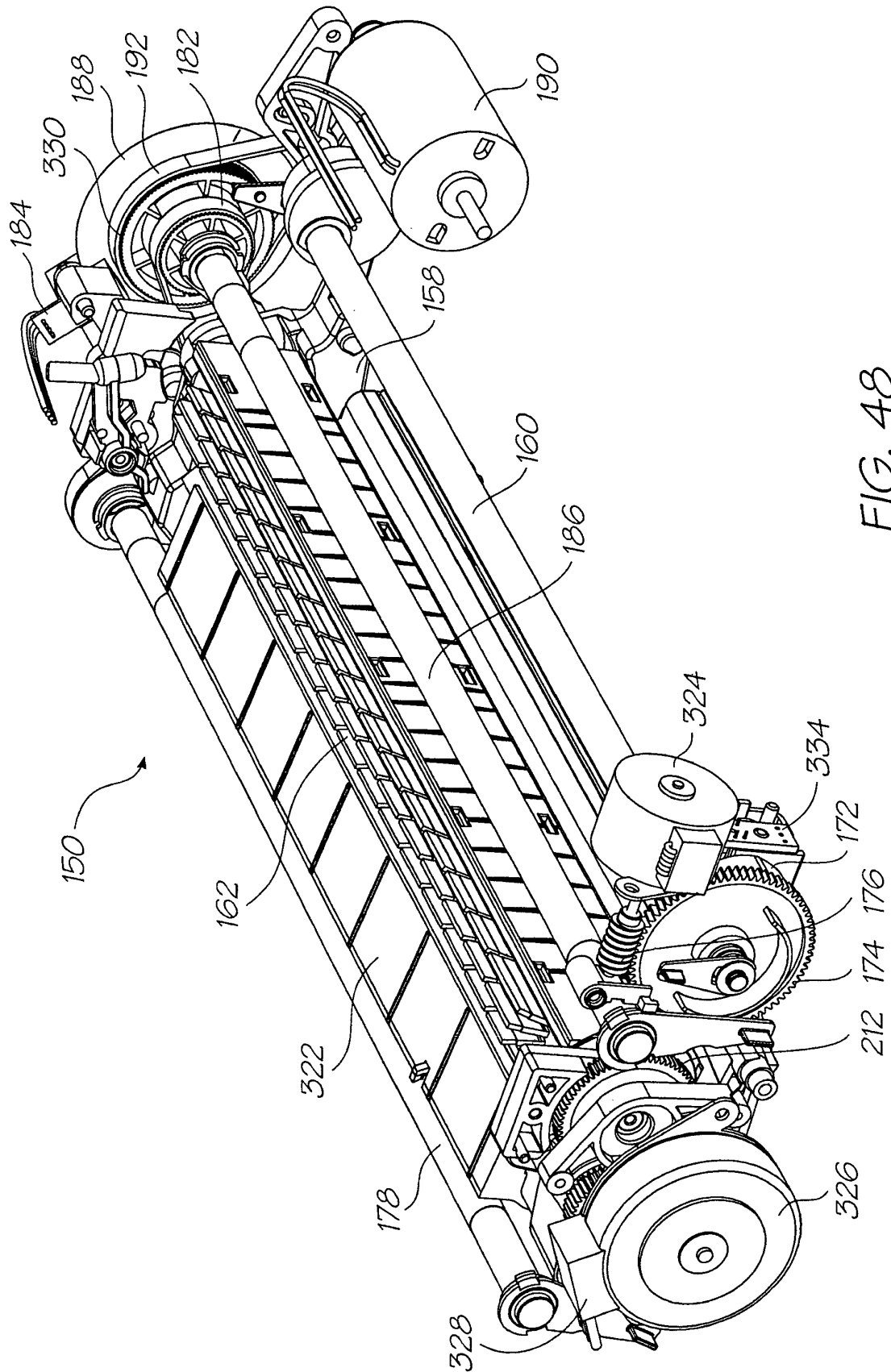


FIG. 47



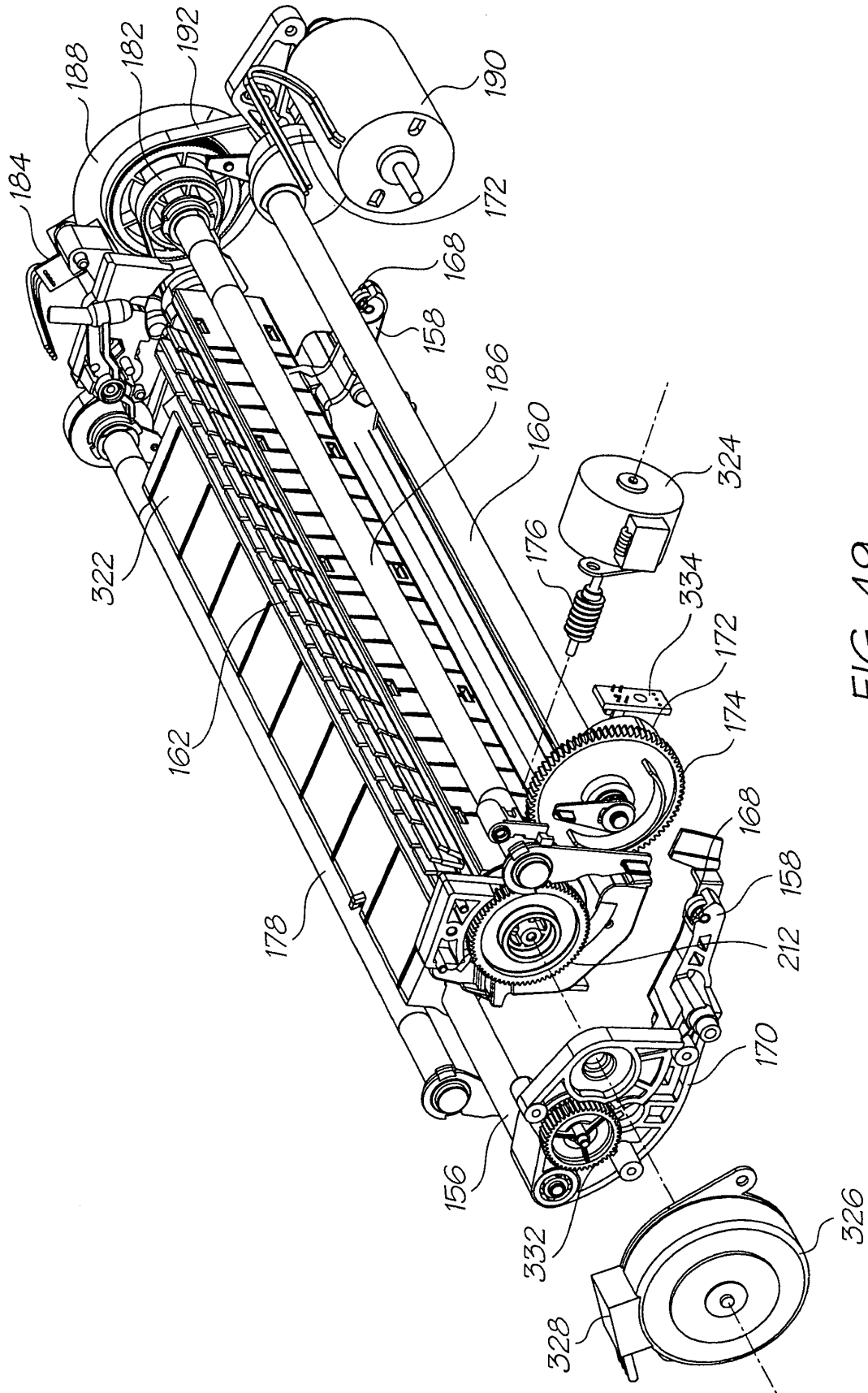


FIG. 49

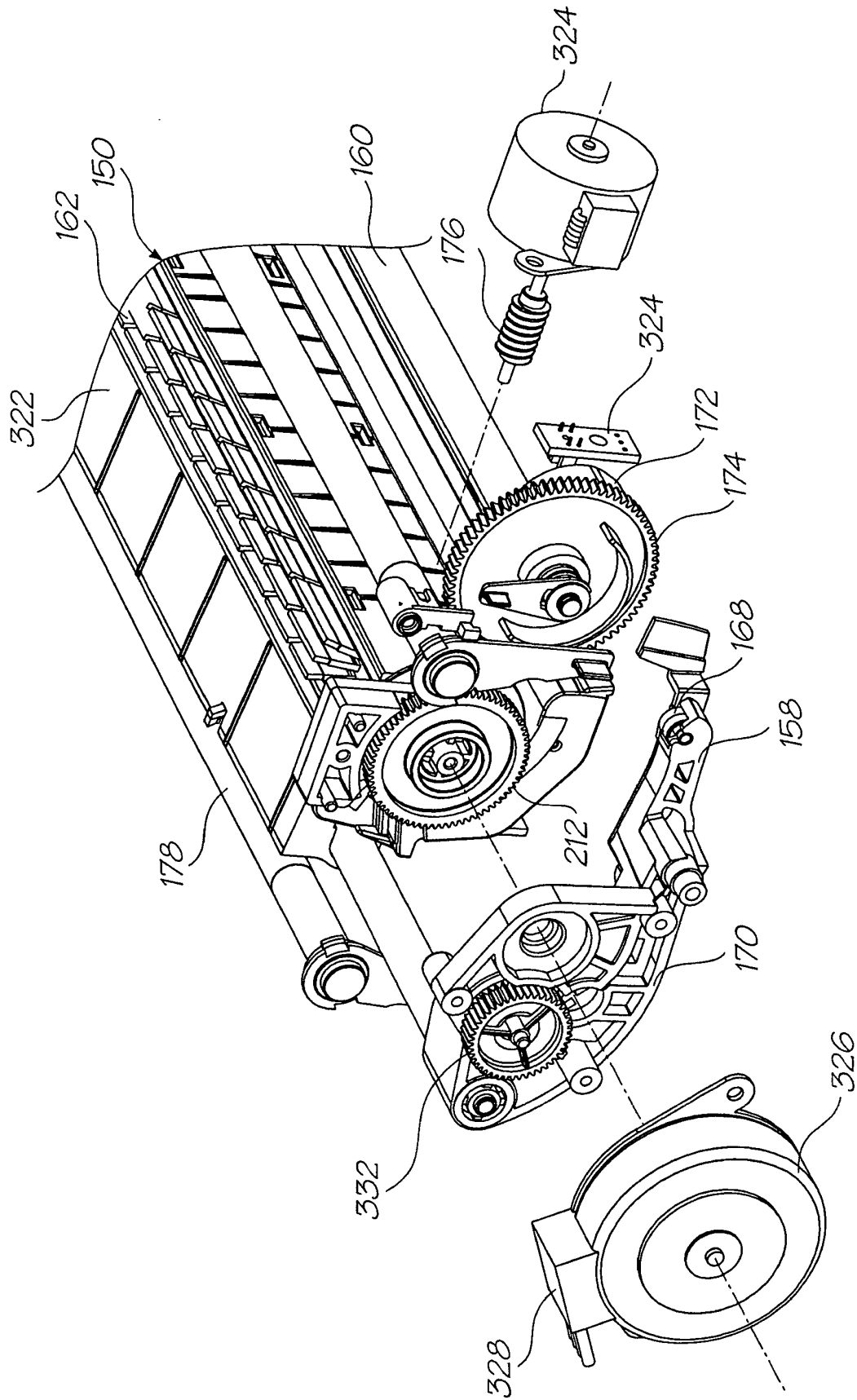


FIG. 50

REFERENCES CITED IN THE DESCRIPTION

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