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(72) Inventor: Sturman, John P.
Vancouver, WA 98684 (US)

(74) Representative: Colgan, Stephen James et al
CARPMAELS & RANSFORD
43 Bloomsbury Square
London WC1A 2RA (GB)

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(71) Applicant: Hewlett-Packard Company
Palo Alto, California 94304 (US)

(54) Fluid interconnect mechanism and method for an inkjet printer

(57) Disclosed is a printer having a set of permanent or semi-permanent inkjet printhead units (pens) (28-34) and a remote ink supply (20-26) connected to the pens by means of trailing tubes (44). A precision latching mechanism is provided to precisely position the pens in their respective stalls (76-82). The fluid interconnect device for the pens is designed so that it does not counteract the precision alignment provided by the pen and carriage datums. The carriage has a valve member (132-138) with a septum (148), and the valve is connected to the carriage in such a way that it can rock and otherwise move a preselected limited amount with respect to the carriage. The pens each have a needle (54) designed to pierce the septum. The needle is located inside a shroud (56) connected to the pen by a neck member (58). As the pen is inserted into the carriage, the neck member fits within a notch (100) in the carriage. The engagement of the neck member in the notch positions the shroud (56) over the valve. As the pen is further inserted into the carriage, the shroud contacts the valve to thereby position the septum below the needle. As the pen is further inserted, the needle pierces the septum to fluidically connect the pen to the ink supply in the printer. A latching mechanism firmly locks the pens into the carriage so that the pen datums are positioned against the carriage datums to precisely locate the pens in their stalls.

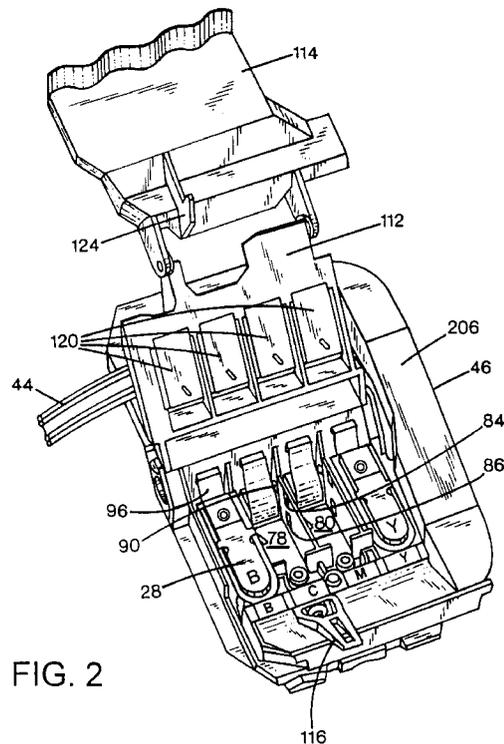


FIG. 2

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to inkjet printing, and particularly to a mechanism for fluidically connecting an inkjet printhead (pen) to an ink supply and mechanically positioning pen within a printer carriage.

Statement of the Art

The assignee of the present application, Hewlett-Packard Company, has for many years sold a successful line of inkjet printers that use a disposable inkjet print cartridges. Such disposable print cartridges have an inkjet printhead and an integral ink supply, containing, for example about 10 to 50 cc's of ink. The print cartridge is scanned back and forth across the print zone as the desired characters are printed by ejecting droplets in a dot matrix fashion. The printhead is designed to last long enough to use up all of the ink in the cartridge so that users get good print quality throughout the life of the print cartridge. When the ink in the print cartridge is used up, the entire cartridge is discarded.

Recent advances in printhead construction have allowed printheads to be designed to be a permanent or semi-permanent part of the printer, with separate ink cartridges that are fluidically connected in some fashion to the printhead. When the ink is used up, the ink cartridge is replaced, but the sophisticated printhead device remains in the printer. One approach to providing the fluid connection between the ink cartridges and the printhead is to connect the ink cartridges to the printhead by means of flexible tubes. As the carriage scans the printhead device (which is often called a "pen") back and forth, the tubes flex back and forth, continually feeding ink to the pen. The present invention is directed this type of printing system, which may be referred to as a "trailing tube" design. It has also been called to as an "off-axis" system, because the ink supply is off the print scanning axis.

Various problems present themselves in design of current inkjet printers. Modern inkjet printers print at very high resolution, for example, 600 or even 1200 dots-per-inch (DPI). As resolution increases, droplet size typically decreases. With increased resolution and decreased dot size, it becomes more important that the pens be precisely located in the carriage. To accomplish accurate positioning of the pen in the carriage, the pen typically has a set of physical X, Y, and Z datums that are seated against a corresponding set of datums in the carriage stall.

Modern inkjet printers typically print in color and have a plurality of color pens, usually printing in cyan, magenta, yellow, and black. It is often desirable to provide a different pen for each color, so that if a single pen

goes bad, only that pen need be replaced. However, each pen must be precisely aligned with the other colors, or the print quality of the printed images will be degraded. Therefore, the system must not only accommodate precision placement of the pens in the stalls, but precise alignment among the colors.

In addition to the mechanical positioning of the pens within the carriage, the pens must be fluidically connected to the trailing tubes. The pens usually interface with some type of valve on the ends of the tubes. The pens make connection with these valves when they are inserted into the carriage stall. However, if the pen and valve interface is not correctly designed, the forces exerted on the pen during fluid interconnection will counteract the precision positioning of the datums, resulting in the pens being misaligned. The fluid interconnection mechanism must be designed so as to not act against the precise positioning resulting from the interaction of the datums.

Although the pens are preferably a permanent fixture in the printer, rather than being disposable, it is likely that many such pens will fail before the end of the life of the printer. Therefore, some provision must be made so that the pen can be removed and replaced with a new one. The mechanical datum system and fluid interconnect must also allow the new pen to be reliably and precisely positioned during such replacement. The system would be preferably designed so that installation and subsequent replacements could be done by a purchaser or by a field repair person away from factory conditions.

SUMMARY OF THE INVENTION

The invention provides an inkjet printing mechanism designed to receive an ink jet pen having pen datums configured for positioning the pen within a printer carriage. The printer includes a printer chassis and a media movement mechanism mounted to the chassis and constructed to position a print medium in a print zone. A carriage is mounted to the chassis and is constructed to position the inkjet pen over the print zone. The carriage has a set of carriage datums constructed to interface with the pen datums. A latching mechanism is associated with the carriage and constructed to seat the pen datums against the carriage datums to finely position the pen with respect to the carriage. A fluid interconnect mechanism constructed to interface with and fluidically connect to the pen. The fluid interconnect mechanism is connected to the carriage to move a preselected limited amount with respect to the carriage when interfacing with the pen so it does not interfere with the fine positioning of the pen with respect to the carriage.

The invention also provides a method of registering an inkjet pen having pen datums into a carriage of an inkjet printing mechanism. The method includes the steps of: (a) placing the pen in a stall of the carriage; (b) interfacing the pen with a valve associated with the car-

riage; (c) moving the valve with respect to the carriage in response to the step of interfacing; (d) making fluid interconnection between the pen and a valve; seating the pen datums against carriage datums to finely position the pen within the carriage; (e) allowing the valve to move a preselected limited amount with respect to the carriage so that the step of interfacing between the pen and the valve does not interfere with the fine positioning of the pen with respect to the carriage.

The invention thus allows for a fluid interconnection that does not act against the precise positioning resulting from the interaction of the pen and carriage datums.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective, partial cutaway view of a printer of the invention.

Fig. 2 is a perspective view of a carriage and a latching mechanism of the invention.

Figs. 3 and 4 are perspective views of an inkjet pen of the invention.

Figs. 5-7 are perspective views of a latching mechanism in various latching positions.

Fig. 8 is a front view of a valve assembly.

Fig. 9 is an exploded perspective view of valve 132.

Fig. 10 is a side view of valve 132 in a rocking position.

Fig. 11 is a top view of valve 132.

Fig. 12 is a perspective view of manifold 46 with cover 206 removed.

Fig. 13 is a perspective view of manifold 46 with tubes 172 and 174 misplaced.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Fig 1 is a cutaway view of a printer 10 of the invention. Printer 10 includes a chassis 12, carriage rod 14, carriage 16, ink cartridge stall 18, ink cartridges 20, 22, 24, 26, printheads (pens) 28, 30, 32, 34 (shown in outline), controller 36 (shown in outline), input tray 38, and output tray 40. Controller 36 communicates with pens 28, 30, 32, 34 by means of a flex strip 42, in a manner well known in the art. Ink cartridge 20 holds black ink, cartridge 22 holds cyan ink, cartridge 24 holds magenta ink, and cartridge 26 holds yellow ink. Similarly pen 28 prints black dots, pen 30 prints cyan dots, pen 32 prints magenta dots, and pen 34 prints yellow dots. Ink is fed from ink cartridges 20, 22, 24, 26 to pens 28, 30, 32, 34 by means of tube assembly 44. Tube assembly 44 connects with manifold 46, and inside manifold 46 the individual tubes carrying the four colored inks are separately routed to their respective valving mechanisms so that ink can be fed to the pens. Carriage 16 is shown in Fig. 1 in its "home" position at the right side of the print zone. The print zone resides between this home position and the left side 48 of chassis 12.

Carriage 16 rides along carriage rod 14 and traverses in the direction labeled X back and forth to thereby scan the pens across the print zone as dots are laid down on the page in a dot matrix pattern. For this reason, the direction X is commonly referred to as the carriage axis or scan axis. Flex strip 42 is a flexible conductor that flexes back and forth as the carriage scans back and forth across the print zone. Similarly, tube assembly 44 flexes back and forth to provide a continuous supply of ink to the pens.

After a print swath is complete, the paper or other print media is incrementally moved one swath width in the direction labeled Y, so that another print swath can be printed. Subsequent contiguous swaths are printed to print entire pages of text or images in a manner well known in the art. The direction orthogonal to directions X and Y will be referred to herein as the Z axis. After a page of information is printed, the page is ejected onto the output tray 40, and a new sheet is "picked" from the input tray so that it can be printed on.

Figs. 3 and 4 illustrate pen 28 in detail, and is typical of pens 28, 30, 32, 34. This pen includes printhead nozzles 50, electrical interconnect pads 52, fluid interconnect needle 54, shroud 56, and neck 58. Pen 28 has X datums 60, 62, 64; Z datums 66 and 68; and Y datum 70. Contact pads 52 interface with a set of matching contact pads in the printer so that the printer can provide firing signals to the pen. Based on these firing signals, droplets are ejected from nozzles 50. Needle 54 interfaces with a septum, described later, to provide a supply of ink to the pen. Shroud 56 covers and protects needle 54. Both shroud 54 and neck 58 serve to guide the needle into its interface with its septum. These functions are described more completely below.

Figs. 2, 12, and 13 illustrate details of carriage 16, and includes pen stalls 76, 78, 80, 82. Pens 28, 30, 32, 34 are installed into stalls 76, 78, 80, 82, respectively. Stall 76 is typical and will be described in detail. Stall 76 includes X, Y, and Z datums that correspond directly with the X, Y, and Z datums on pen 28, described in reference to Figs. 3 and 4. For example, in Fig. 2, X datums 84, 86 and Z datum 90 are visible in stall 78, which datums correspond to the datums on pen 30. Stall 76 also includes contact pads 96 and notch 100. A spring is positioned behind contact pads 96 to bias the contact pads outward, or in the direction of the notch 100.

As pen 28 is installed into stall 76, neck 58 fits into notch 100. As the pen is further installed, spring 98 urges the pen toward the right (as viewed in Figs 3 and 4) to bias X pen datums 60, 62, and 64 against the X carriage datums to position the pen in the X direction within the carriage. Carriage contact pads 96 engage with pen contact pads 52, so that the printer can communicate with the pen. Also, because of the spring behind contact pads 96, Y pen datum 70 is urged against its carriage datum to position the pen in the Y direction. By means of a latch mechanism described below, Z pen datums 66 and 68 are urged against the Z carriage datums to

position the pen in the Z direction. Thus the pen is precisely positioned in the X, Y, and Z directions with respect to carriage 16 so that droplets are accurately deposited on the page in their intended location.

Fig. 2 and Figs 5-7 illustrate details of the latching mechanism that latches pens 28, 30, 32, and 34 into their respective stalls so that the pen datums are all firmly held into position against their respective carriage datums. This mechanism includes a carriage chassis 110, latch 112, handle 114, and pivot arm 116. Carriage chassis rides along carriage rod 14 at hole 118. A set of contact arms 120 is pivotally connected to latch 112, as shown, and a spring (not shown) is mounted behind each of contact arms 120 to urge contact arms 120 outward or away from latch 112. Handle 114 includes a hook 124, designed to interlock with pivot arm 116, as described below. Latch 112 is pivotally attached to carriage chassis 110, and handle 114 is in turn pivotally attached to latch 112, as shown. Pivot arm 116 is pivotally attached to carriage chassis 110, as shown.

Fig. 2 shows the latch mechanism in its fully open position, with latch 112 flipped back toward the rear of the printer and handle 114 rotated back behind latch 112. Pivot arm 116 is rotated forward out of the way. With the latch mechanism in this position, pens can be installed or exchanged. Fig. 5 shows the latch mechanism in a second position in which latch 112 is rotated forward (clockwise as viewed in Fig. 5) so that contact arms 120 are pushing against the pens. Handle 114 is rotated so that hook 124 is interlocked with pivot arm 116. Handle 114 is held by the user to move the mechanism from the orientation shown in Fig. 2 to the one shown in Fig. 5. After hook 124 is interlocked with pivot arm 116, the user rotates handle 114 back toward the rear of the printer (or counterclockwise as viewed in Figs. 2, and 5-7). As the handle is thus rotated, latch 112 will be urged downward so that contact arms 120 are urged against the pens by means of springs mounted behind each contact arm. As the user rotates handle 114 toward the position shown in Fig. 7, he will feel a force, resulting from the springs behind contact arms 120, urging the handle to rotate back to the orientation shown in Fig. 5.

When the mechanism reaches the orientation shown in Fig. 6, the forces reach an equilibrium, and in this position, the mechanism may therefore be said to be moving through to an over-center position. As the user continues to rotate handle 114 toward the position shown in Fig. 7, the forces resulting from the springs behind contact arms 120 will urge handle 114 to continue rotating, until the handle is in its position shown in Fig. 7. Thus, the orientation shown in Fig. 7 is in a stable energy state, and the handle is therefore in a locked position so that the pens are firmly held in place. The motion of the latching mechanism from the position shown in Fig. 5 to the position shown in Fig. 7 may be referred to as a latching motion. When it is desired to replace a pen, the user will rotate handle 114 back through the over-center position (Fig. 6), and back to the position

shown in Fig. 5. The user will then rotate the handle 114 and latch 112 back to the position shown in Fig. 2.

Figs. 8 through 13 illustrate the fluid interconnect mechanism in carriage 16 that interfaces with the pens to supply ink to the pens. As shown in Fig. 8, this mechanism consists of floor 130 of manifold 46, valves 132, 134, 136, 138, and snap rings 140, 142, 144, 146. Valve 132 shown in Figs. 9-11 is typical of valves 132, 134, 136, 138. Valve 132 has an elastomeric septum 148 (See especially Fig. 11) with a pre-formed slit 150. Septum 148 is held in place on valve 132 by means of an aluminum crimp cap 152. Valve 132 has a arc-shaped rolling member 154, a stem 156, and a beveled shoulder 158 at the bottom of stem 156. As shown in Fig. 9, floor 130 has an opening, which is sized to receive shoulder 158 and stem 156. During assembly, stem 156 and shoulder 158 are passed through opening 160 so that arc-shaped rolling member 154 rests on top of floor 130. Retainer clip 140 is then clipped onto stem 156 just above shoulder 158 to hold valve 132 in floor 130.

The interrelationship between valve 132, floor 130, and retainer clip 146 is such that valve 132 is allowed to move with respect to floor 130 a certain limited amount in directions X, Y, and Z, and also allowed to roll as shown in Fig. 10. Rolling member 154 has a radius of 0.5 inch. The parts are constructed so that valve 132 is allowed to "roll" an angle Θ of 5° about the Y axis, so that the crimp cap translates in the X direction. The vertical distance (in the Z direction) from the bottom of the rolling member to the top of the crimp cap 152 is 0.5 inch, which is the same as the radius of the curve of rolling member 154. Rolling member 154 is curved in the X axis, but is flat in the Y axis. Therefore, the valve cannot roll about the X axis, but it can "rock" up on its edges so that the crimp cap translates in the Y direction. Valve 132 is allowed to move in the X and Y directions 1.5 mm. The importance of this preselected limited amount of movement is described below.

Fig. 12 illustrates internal details of manifold 46. Tubes 44 enter manifold 46 at strain relief member 170, as shown. Tube assembly 44 is comprised of a set of four ink tubes bound together by an elastomeric cover that protects the tubes as the carriage scans back and forth. Strain relief member 170 snugly receives this elastomeric member and the internal tubes and keeps the connection point between the tube assembly 44 and the manifold 46 from becoming too tight a bending point. The elastomeric cover of tube assembly ends within manifold 46 at position 171. Beyond position 171, the individual tubes 172, 174, 176, and 178 are individually routed within manifold 46 to their respective valves 132, 134, 136, and 138, as shown.

Manifold 46 curves each of the respective tubes in smooth arcs as they are routed to their respective valves. The ink tubes are made of polychlorotrifluoroethylene (PCTFE), also known by the trademark ACLON (TM), which is a material designed to minimize vapor transmission from the tubes to the ambient air. Unfortu-

nately, this material is also quite soft and deformable. It is important that these tubes are not bent over too tight a curve, so that a pinch point does not form. A pinch might cause excessive backpressure in the line or even total fluid restriction, thereby precluding printing in the particular color corresponding to the pinched tube.

It is also important that manifold 46 be constructed to allow ease of assembly, and to provide an assembly that is as error free as possible. In view of the delicate nature of the tubes and other factors, the tubes within manifold 46 are assembled by hand. It is important in such hand assemblies that the parts be designed to minimize any potential for error on the part of the worker doing the assembly. For example, the colors actually printed by the printer would be completely incorrect if the tubes were routed to the wrong valves, and therefore supplied the wrong colors of ink to the pens.

In accordance with these design objectives, manifold 46 has various barriers, walls, and clips to channel the ink tubes. Tube 172 carries black ink, tube 174 carries cyan ink, tube 176 carries magenta ink, and tube 178 carries yellow ink. Each of the tubes has a different length, and the different lengths of the tubes assists in the assembly of the tubes and valves in the manifold 46. The valves 132, 134, 136, 138 are connected to tubes 172, 174, 176, 178, respectively before the tubes are inserted in the manifold.

Tube 178 (yellow) is the shortest tube and has the tightest bending radius at the lower right corner 180 of the manifold, as shown. A barrier 182 separates tube 178 from all of the other tubes and provides a channel 184 for tube 178. A small clip 185 holds tube 178 in place once it is placed in its channel, so that tube 178 cannot pop up and out of its channel. It has been found that since the bending radius of tube 178 is so great in this region, it is important to carefully route this tube by having its own separate channel 184. Additionally, tube 178 is isolated in its own channel 184 to keep it from being entangled in the other tubes. This is important because if tube 178 is entangled in the other tubes, its effective length (i.e., its length beyond the point of entanglement) is so short that it exerts an unacceptable amount of force on valve 113, and hence, on pen 34. This is true because the tubes are bent over an arc within their channels, and the net force exerted by the tubes is related to the length of the tubes within their channels. The longer the effective tube length of the tubes within their respective channels, the less the force the tubes will exert on their valves, and hence the less the force will be exerted on the pens. The design objective is to minimize the forces exerted by the tubes and valves on the pens, so that the action of the pen and carriage datums is not interfered with.

As can be seen, barrier 182 curves around to the left to provide a curved outer surface for channel 184. An island 186, positioned near valve 132, and a small curved wall 188 provide the outer wall in this region of channel 184, to further channel tube 178. A wall 189

forms the inner wall for channel 184.

Wall 182 and outer wall 190 provide a channel 192 for tubes 172, 174, 176 (black, cyan, and magenta). Tubes 172, 174, and 176 are held within channel 192 by means of clip 194. Island 186 and curved wall 188 provide an inner wall for channel 195, which guides tube 176 toward its valve 136. Island 196 provides the outer wall for channel 195 and the inner wall for channel 197, which guides tube 174 toward its valve 134. Island 198 and curved wall 200 form the outer wall for channel 197 and the inner wall for channel 202, which guides tube 172 toward its valve 132. Exterior wall 204 provides the outer wall for channel 202.

During assembly, tubes 172, 174, 176 are first placed in channel 192 and under clip 194. Each of these tubes is then routed to its proper positions in decreasing order of their lengths, and the valves are installed in their respective openings in floor 130, as described in reference to Fig. 9. First tube 172 and valve 132 are installed, then tube 174 and valve 134, and then tube 176 and valve 136. Finally tube 178 (the shortest tube) is placed in its channel 184 and clipped under clip 185. Tube 178 is then routed around wall 189 and inside of wall 182. Valve 138 is then connected to the floor 130. The assembler can thus use the tube lengths to help him assemble the tubes and valves within manifold 46. After the tubes and valves are installed, the cover 206 shown in Fig. 2 is installed on manifold 46 and the manifold is installed in the printer as shown in Fig 1. With the manifold thus installed, the carriage 16 is ready to receive pens 32, 34, 36, 38 so that fluid interconnect can be made to the pens.

Fig. 13 illustrates what happens if the person doing the assembly of the ink tubes within manifold 46 makes an error. In Fig. 13, valve 134 has been improperly switched in its position with valve 136. In this configuration, tube 174 has been improperly stretched over wall 200 and will protrude above where it should be, and will not fit within one of the channels provided. Also, tube 172 extends outside of the manifold 46 and does not fit within any of the channels. It also crosses over the top of tube 174. In this case of a mix-up, wall 200 serves to place the misplaced tubes in a position so that the problem is clearly visible to the person doing the assembly. Moreover, as the person attempts to install cover 206, the misplaced tubes will interfere with cover 206 being properly placed, thus further indicating to the assembler that the valves and tubes are not correctly positioned. Similarly the other walls, barriers and clips in the manifold will cause the tubes to protrude or be stretched across and over walls in such a way that if one of the valves is positioned in an incorrect location, the assembler will easily be able to see the problem and correct it.

The process for installing pens is now described. This description is given with regard to pen 28, with the understanding that the process for installing the other pens is the same. The user grasps one pen 28 with the needle and printing nozzles facing down as shown in

Fig. 3 and begins to position it within its stall 76. Pen 28 is positioned so that pen contact pads 52 are closest to carriage contact pads 96. Spring 98 has a high spring tension and urges pen 28 to the right as viewed in Fig. 2. Because of the spring behind carriage contact pads 96, contact pads 96 also urge pen 28 toward the front of stall 76 (i.e., toward notch 100). Because of the frictional forces between the pen and the walls of the stall, the user will need to use some force to push the pen downward into its stall.

As the user further pushes pen 28 into its stall, neck 58 will engage within and interface with notch 100. As this happens, notch 100 positions shroud 56 over valve 132. As the user further pushes the pen down, shroud 56 will engage with valve 132 to locate valve 132 within shroud 56 and also positions needle 54 above septum and in position to pierce slit 150.

As stated earlier, valve 132 is constructed so that it can move a preselected limited amount with respect to the manifold 46. Thus, as the shroud 56 engages valve 132, shroud 56 will roll and move valve 56 into position so that needle 54 can pierce the slit 150, but the movement of valve 132 will require very little force exerted by shroud 56. It is important that the engagement between shroud 56, needle 54, and valve 132 (including septum 148) not exert forces on pen 28 large enough to counteract the action of the pen datums and carriage datums in precisely positioning the pens within the carriage. As the user further pushes the pen down, needle 54 pierces slit 160 of septum 148. The pen 28 is driven further down until the user feels sufficient resistance to know that the pen is at the bottom of its stall.

The other pens 28, 30, and 32 are similarly installed. At this point, the latching mechanism is used, as described in reference to Figs. 2, 5, 6 and 7 to latch the pens into their stalls and to firmly position the pen datums against their respective carriage datums. At this point, the pens are precisely located in their stalls in the carriage and the fluid interconnect is made, so that the printer is ready to print.

After the pens are fully inserted in the stall, because of frictional forces between the needle and septum, the septum will be deformed slightly downward. Because of the elastomeric nature of the septum material, the septum will exert residual upward forces on the needle. The valves are allowed to "roll" about the Y axis (which allows them to translate laterally in the X direction) and to "rock" about the X axis (which allows them to translate laterally in the Y direction.) This angular displacement can result in the residual forces from the septum resolving themselves along the X and/or Y directions.

As described above in reference to Fig. 8, the radius of curvature of the rolling member (0.5 inch) is the same as the height of the valve from the curved surface of the rolling member to the top of the crimp cap. With this configuration, as the needle is installed in the septum, little or no resultant force is transmitted to the pen in along the X axis. It is very important that the forces in the X

direction are kept as low as possible.

Because the pen "rocks" rather than rolls in the Y direction, the septum can exert higher forces in the Y direction. The amount of force resolved in the Y direction is proportional to the width of the rolling member 154 in the Y direction. Therefore, the width of this member is kept small enough in the Y direction to keep these forces are low enough that they are acceptable

Claims

1. An inkjet printing mechanism designed to receive an ink jet pen having pen datums configured for positioning the pen within a printer carriage, the printer comprising:

a printer chassis;
 a media movement mechanism mounted to said chassis and constructed to position a print medium in a print zone;
 a carriage mounted to said chassis and constructed to position said inkjet pen over said print zone, said carriage having a set of carriage datums constructed to interface with said pen datums;
 a latching mechanism associated with the carriage and constructed to seat said pen datums against said carriage datums to finely position said pen with respect to said carriage; and
 a fluid interconnect mechanism constructed to interface with and fluidically connect to said pen, said fluid interconnect mechanism being connected to said carriage to move a preselected limited amount with respect to said carriage when interfacing with said pen so that said fluid interconnect mechanism does not interfere with the fine positioning of said pen with respect to said carriage.

2. A printing system- according to claim 1, wherein said fluid interconnect mechanism further comprises a valve movably connected to said carriage.
3. A printing system according to claim 2, wherein said pen has a needle for connection to a septum and a shroud surrounding said needle, and wherein said valve has a septum configured to be pierced by said needle, said valve being movably connected to said carriage and configured to fit within said shroud so that said shroud positions said septum proximate said needle.
4. A printing system according to claim 3, wherein said valve is connected to said carriage to rock with respect to said carriage.
5. A printing mechanism according to claim 4, wherein

said valve has a stem and said carriage has a hole, said valve being connected to said carriage by means of said stem passing through said hole and a retainer member being attached to said stem.

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6. A printing system according to claim 3, wherein said valve is connected to said carriage to move radially with respect to said carriage.

7. A method of registering an inkjet pen having pen datums into a carriage of an inkjet printing mechanism, the method comprising the steps of:

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placing said pen in a stall of said carriage;
 interfacing said pen with a valve associated with said carriage;
 moving said valve with respect to said carriage in response to said step of interfacing; making fluid interconnection between said pen and a valve;
 seating said pen datums against carriage datums to finely position said pen within said carriage; and
 allowing said valve to move a preselected limited amount with respect to said carriage so that said step of interfacing between said pen and said valve does not interfere with the fine positioning of said pen with respect to said carriage.

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8. A method according to claim 7, wherein said step of making fluid interconnection further comprises inserting a needle on said pen into a septum on said valve;

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9. A method according to claim 8, wherein said step of interfacing includes the step of positioning a shroud on said pen over said valve to move said valve with respect to said carriage to thereby position said needle proximate said septum.

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10. A method according to claim 8, wherein said step of moving said valve includes the step of rocking said valve with respect to said carriage.

11. A method according to claim 8, wherein said step moving said valve includes the step moving said valve radially with respect to said carriage.

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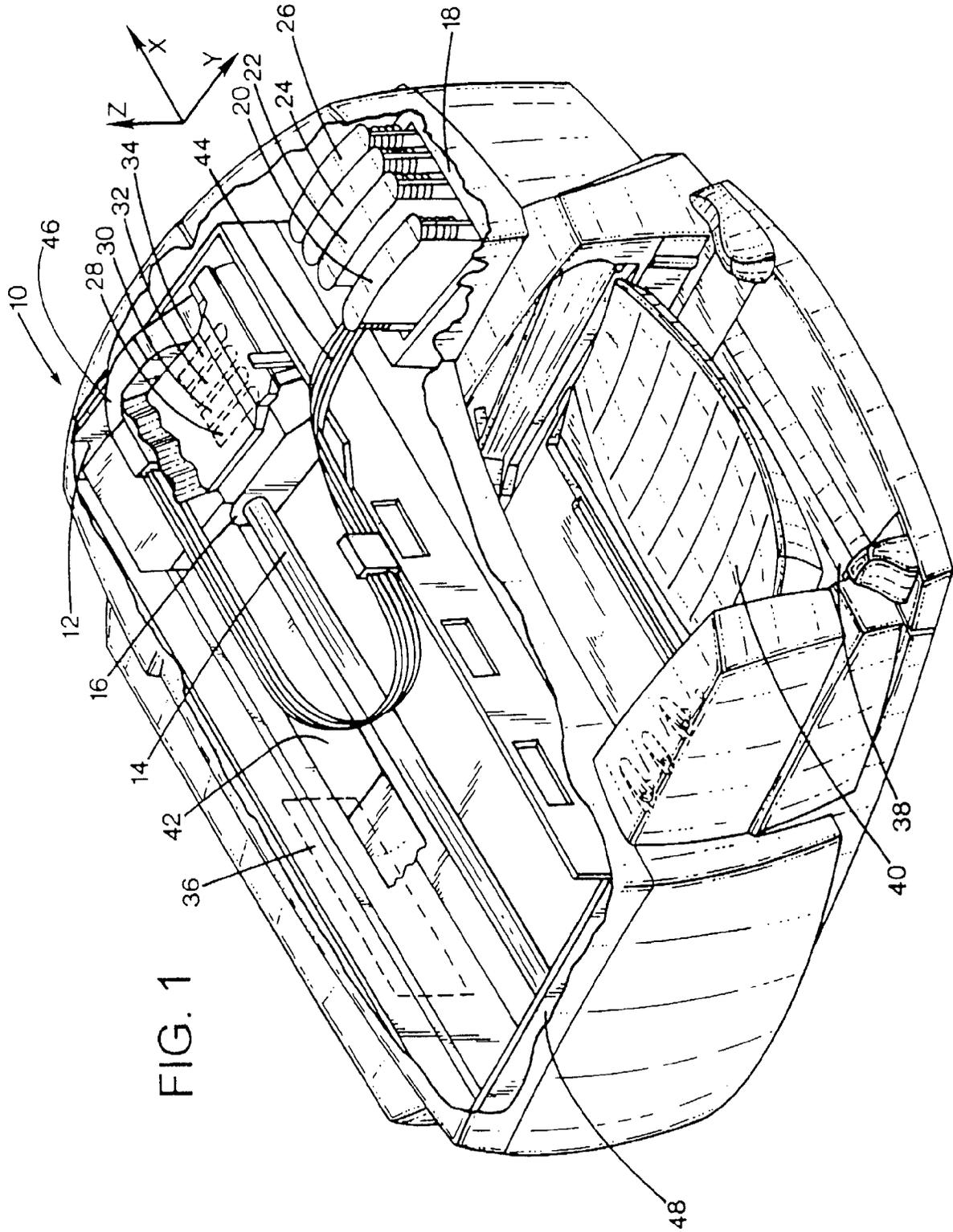


FIG. 1

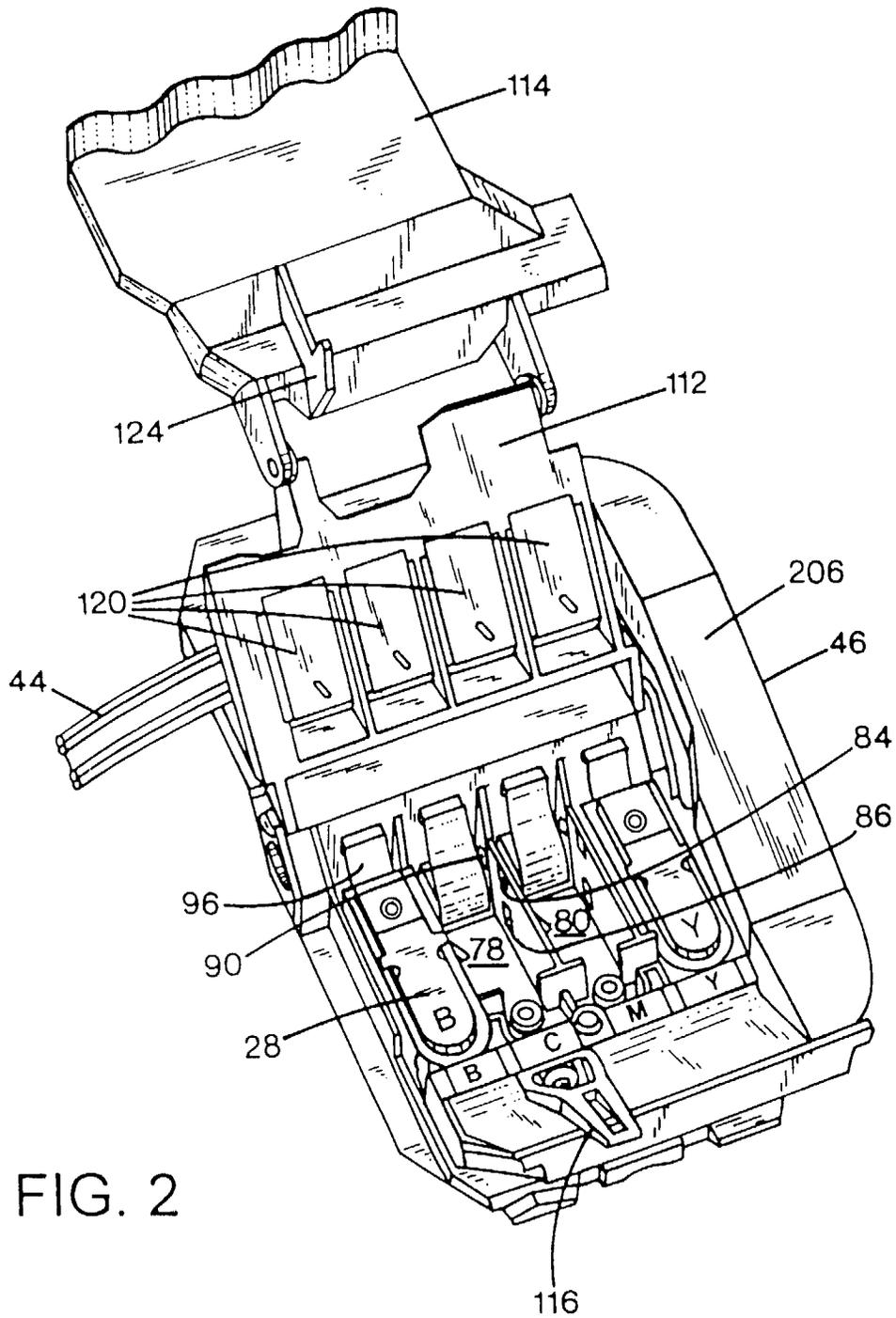


FIG. 2

FIG. 3

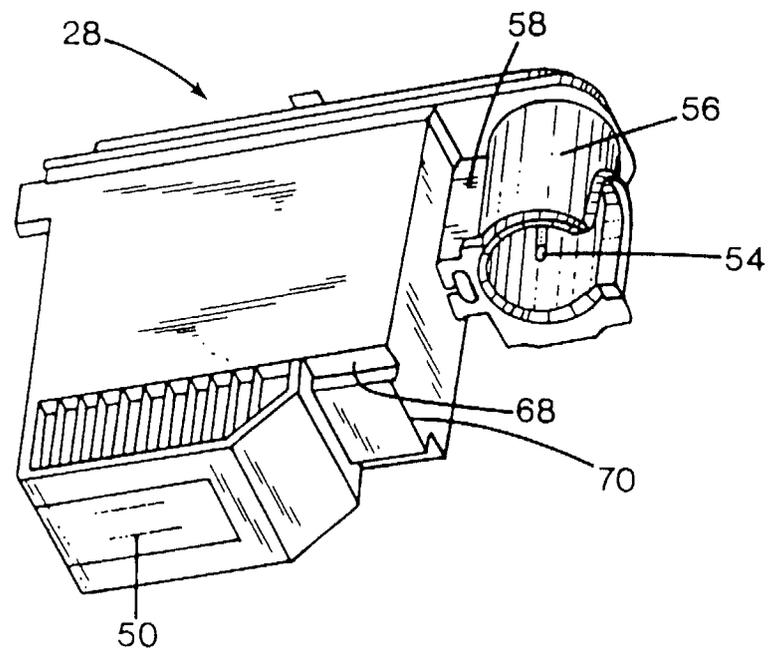
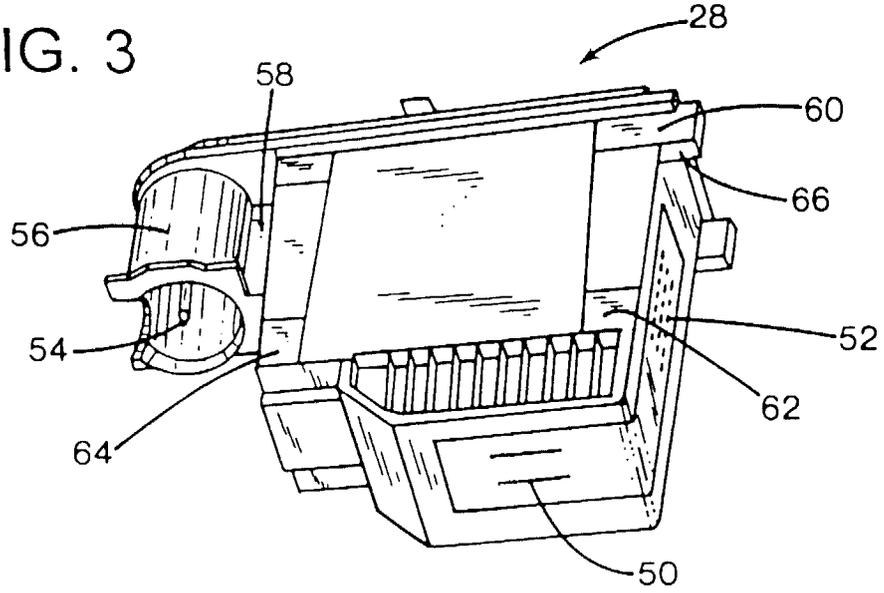
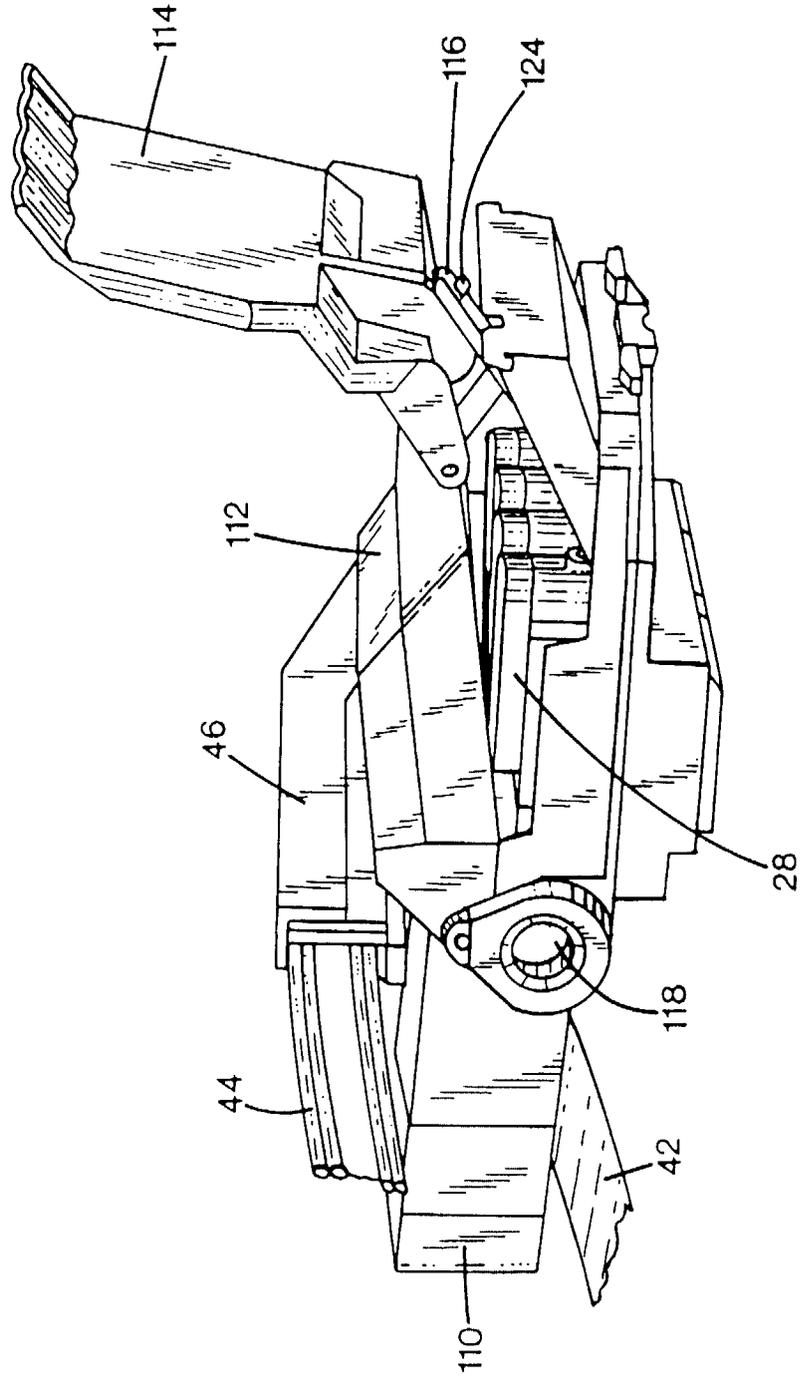


FIG. 4

FIG. 5



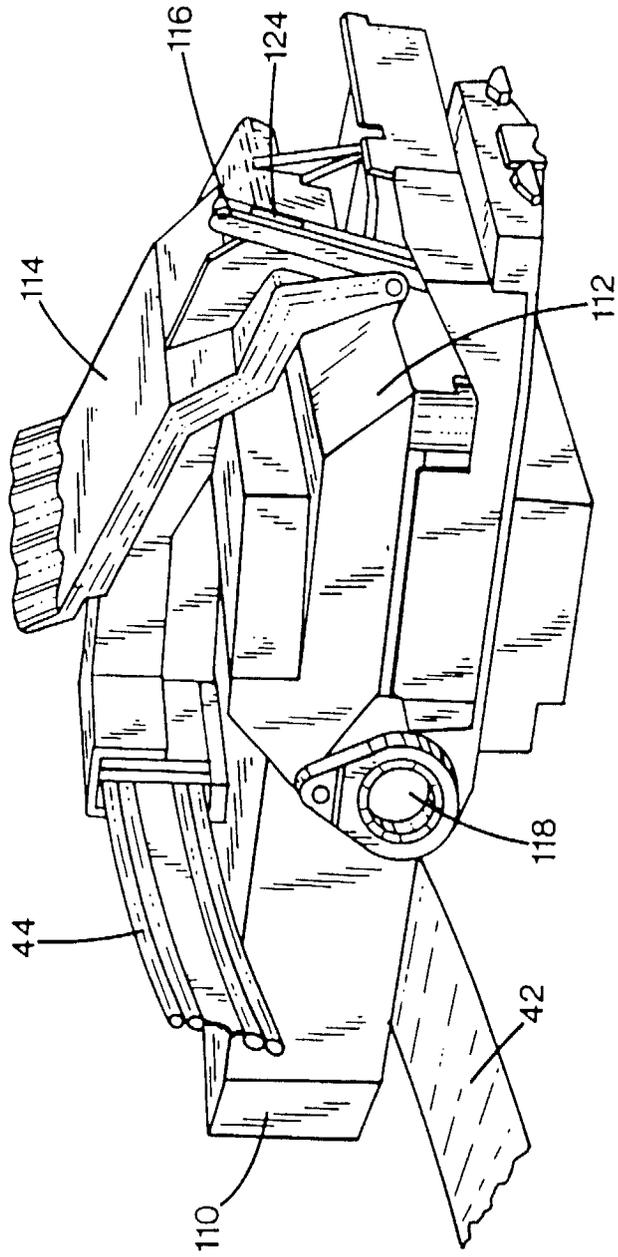


FIG. 6

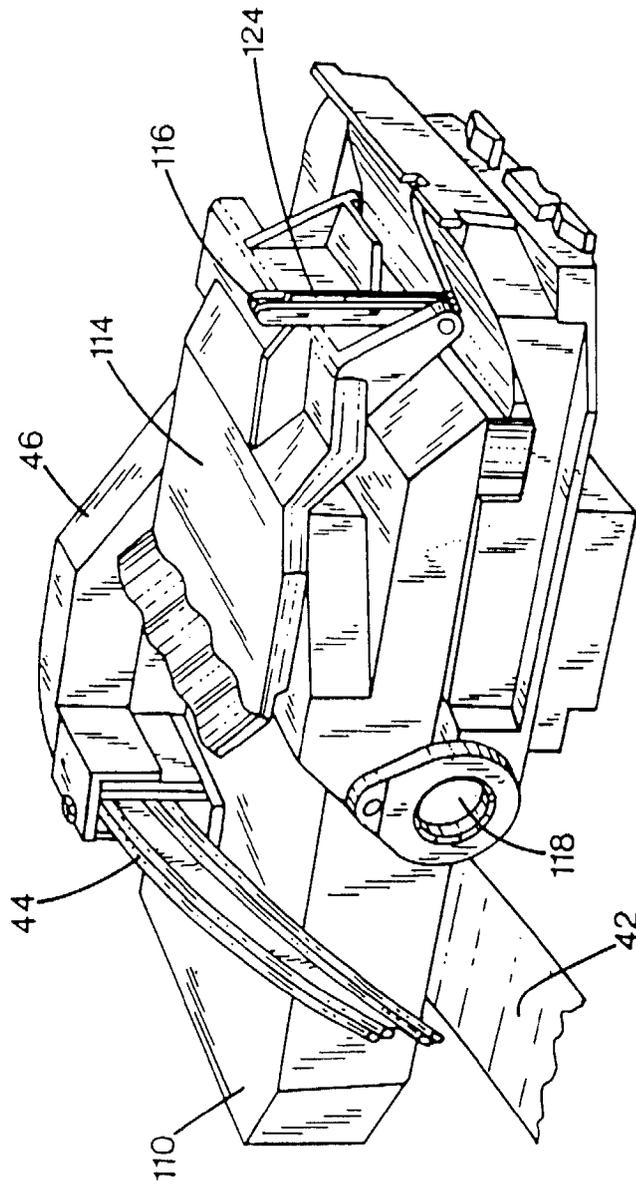


FIG. 7

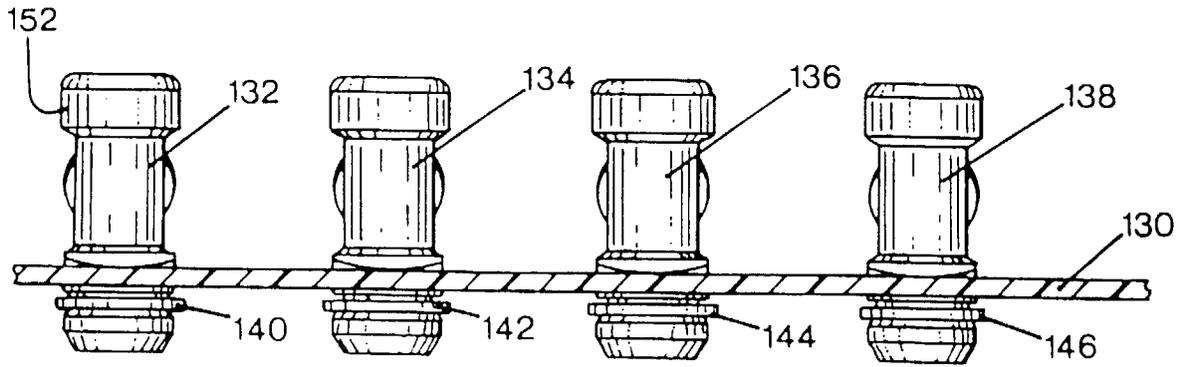


FIG. 8

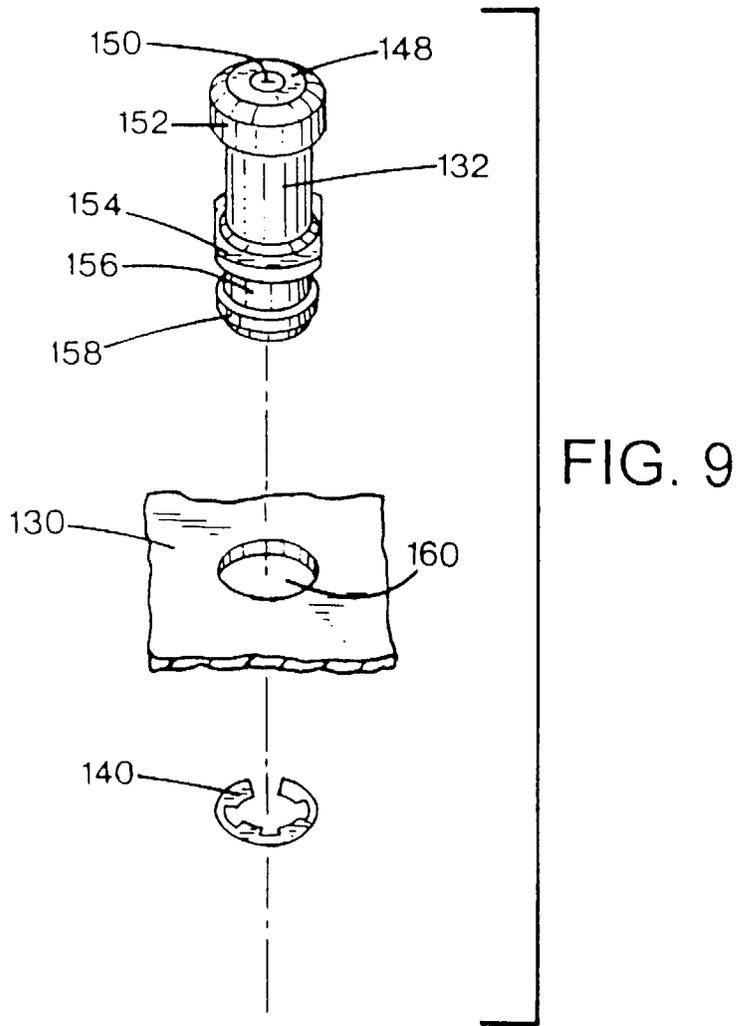


FIG. 9

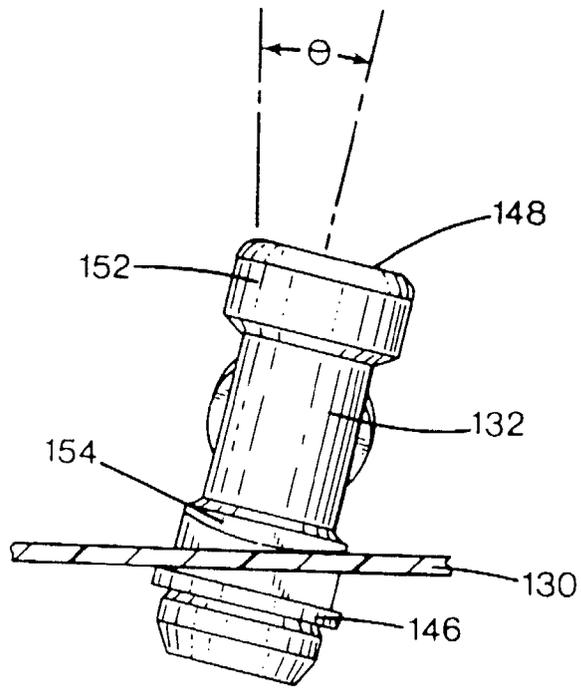


FIG. 10

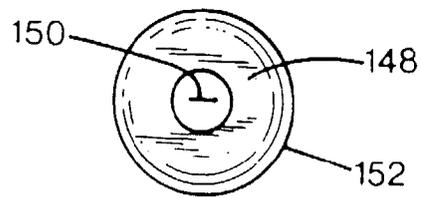


FIG. 11

FIG. 12

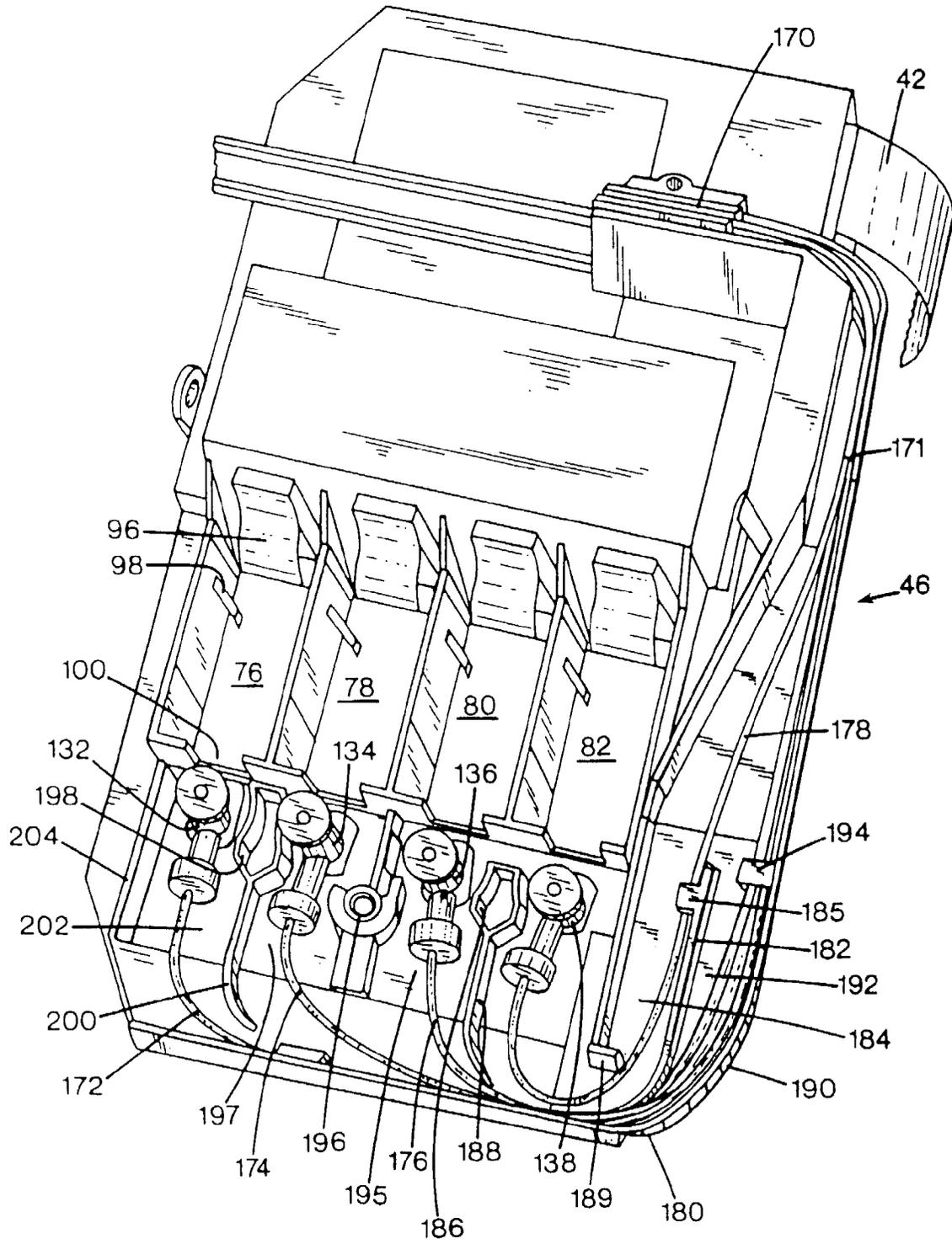


FIG. 13

